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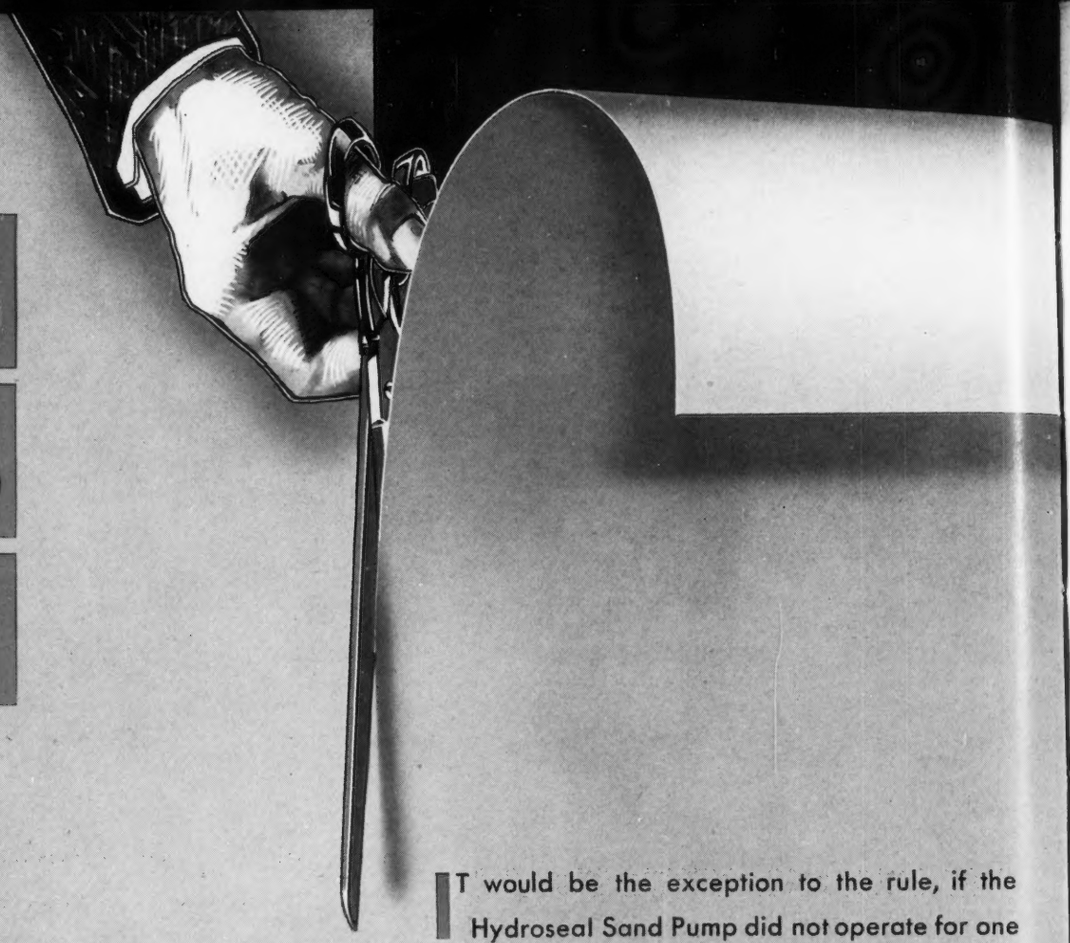

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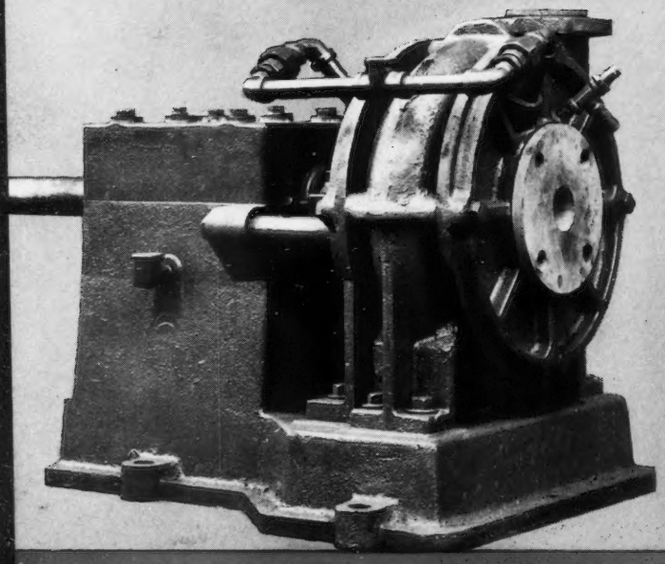

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Recovery Note. United States Mint had to work two or three shifts daily for long periods during 1935 to meet the great demand for domestic coin. The output consisted of 134,166,204 pieces of silver, including 5,635,557 silver dollars, and 474,248,003 pieces of minor coin, of which 412,266,000 were bronze 1c. pieces. The value of the domestic coinage was $39,131,127, compared with $3,499,125 for 1934 This demand on the Mint has been exceeded only twice, in 1918 and 1920.

*

Katagata, a hot spring on Kyangenyi Hill, in the Ankole district of Uganda, British Central Africa, according to the highly interesting Bulletin No. 2 of the Uganda Geological Survey, is warm in the morning and at night only. Amor pi, a non-mineral spring in the middle of the Aswa River, in the Chua district, is very hot, but has cold water on each side of it—a sort of spring sandwich; and Keyo and Keyo Amuro, in the Gulu district, are tepid waters accessible only when the grass is short! Native rulers (Mugabe) inclose Uganda springs within bush fences, constructing therein private baths — or "semi-private" ones. The medicinal value of the hot springs of Africa appears to be known and valued by the local inhabitants. Benefits resulting from bathing in the waters have caused observers to assume that some of them possess a radioactive content.

*

Yellow Light, meaning "Proceed with caution," is one interpretation put on the Supreme Court's decision regarding TVA. A relatively minor issue was decided, still leaving up in the air the question of how far the Government may go in competing with private business. There is a hint of red glare just around the next curve, but it will take more suits to decide whether the light is red or green—or still yellow.

Double Culprit. Already charged with responsibility for silicosis, silica is now believed to be the cause of the so-called caustic embrittlement of steel. Research by the Bureau of Mines leads to the belief that caustic alone is not responsible for embrittlement of steel, but that silica in solution of sodium hydroxide worms its way into the grain boundaries of steel and makes it weak and brittle. The phenomenon has not been explained, but the facts are believed to have been demonstrated.

*

Hot Doggie Doodle. Cal Averite, writing to *Northern Miner* from Catfish Creek, Missouri, declares that he has developed a hound that "can find orebodies in a jiffy." Assisted by Cy Anide and Cal Goorlite, he crossed a werewolf with a Russian hound, to get speed. He then bred the best pup with a mink, "for smelling and endurance." The result, he claims, is a canine that, after sniffing a few pieces of gold, can smell through 200 feet of massive rock or 298 feet of schist. "Sulphide orebodies are her meat. Her specialty is picking out the greatest concentrations, and she is good, also, on coon and possum, and can smell through ice and snow and in wet weather. Her conductivity is without question." O K! O K!! But can she show which way the vein dips and runs—and how far?

*

A Shovel which will scoop up about 45 tons of material at a bite—enough to fill twenty standard Ford dump trucks—and which, with appurtenances, weighs 2,400,000 pounds and required 44 railroad cars for transportation, was recently produced by Bucyrus-Erie at South Milwaukee, Wis. The entire cycle of operations, including movement of the 30-yard shovel more than 200 feet from the point of stripping to a maximum height of 70 feet, requires less than 60 seconds.

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Volume 137 MARCH 1936 Number 3

Let's End the Silicosis Racket

TYPICAL of a vicious attack that may sooner or later be directed at the mining industry, is the public furore aroused in the past 60 days against a tunnel contractor in West Virginia for alleged loss of life and impairment of health of workers due to silicosis. The incident merits the attention of the mineral industries because no more false, lurid, or fantastic tale has ever been told of heartless indifference on the part of an employer to the physical welfare of his employees. And behind it is a record of legal racketeering, in the form of damage suits for millions of dollars, brought by enterprising lawyers on behalf of willing "victims" —all because of lack of adequate legislation on silicosis as a health hazard.

Rumors originating in the West Virginia hills and published sensationally in a radical weekly newspaper ultimately found their way into the daily press. Gauley Bridge, W. Va., was characterized as a "village of living dead men," doomed to death from silicosis. Those already dead were said to be numbered by the hundreds. Air in the tunnel was said to be so dust laden that lights were invisible at 5 ft., and foremen had to club unwilling workers into this "American Black Hole of Calcutta." These and other wild and fantastic charges finally reached Congress and were made the subject of a resolution by Representative Marcantonio, of New York, directing the Secretary of Labor to conduct an investigation. Hearings on the resolution were marked by highly emotional and incompetent statements. The only voice of sanity and authority was raised by Director Finch of the United States Bureau of Mines.

So much for this particular incident. There is not space to review the details. Suffice it to say that a reputable contractor suffered unwarranted injury at the hands of agitators and racketeers. True, he was able to refute the charges and show an exceptionally good record for health and safety, but the damage had already been done. And the incident can be repeated with equally reputable mining companies. Indeed, racketeering silicosis suits are not unknown in the mining industry, nor is there anything to prevent their multiplication.

Isn't it about time to stop this vicious racket? Isn't it about time for the mining industry, the construction industry, and others in which siliceous dusts create a hazard to health, to take a realistic attitude toward silicosis and support a federal investigation of the whole subject by men of competence and authority? Isn't it about time to face the menace of disease and wipe out the menace of the racketeer? Isn't it about time to stop pussyfooting, to lift the subject out of the realm of emotionalism and agitation, and deal with it by sane and intelligent legislation?

The Congressional hearing referred to was in itself futile. Nor can a continuation of such an investigation serve any useful purpose. The subject is highly technical and calls for the opinion of experts in science and engineering. Once their recommendations are available, adequate legislation can be drafted, but not until then. Definitely, we feel that the investigation should be made, not by the Department of Labor, but by the United States Bureau of Mines and the United States Public Health Service, together with representatives of industry, labor, and insurance. A competent board composed of these elements would command respect for its findings and point the way to early control and ultimate elimination of the silicosis peril. This is no light task, but until it is done, and well done, the racket will prevail. American industry has been too long tolerant of both evils—silicosis and the racketeer.

Meantime, the subject is receiving attention from other sources. The Air Hygiene Foundation of America, Inc., has been organized in Pittsburgh and will pursue a program of investigation of air contamination, especially by dust in industries. New York State has pending legislation providing for special and limited workmen's compensation to employees disabled by silicosis, and requiring the use of dust-eliminating devices on all public works. And the industrial commissioner is directed to take steps to control the incidence of

silicosis in all industries. Coincident with these movements is the commercial development of dust-collecting devices to remove and collect dust from the drill and prevent its escape into the air near the operator. In short, the attack is proceeding along several fronts and the whole subject is being illuminated. But the problem is nation-wide and can best be approached by a competent Federal commission as suggested in the foregoing. The time has come for constructive action.

Aluminum Takes a Bow

WITHIN THE MONTH JUST PASSED has been celebrated with fitting ceremony the fiftieth anniversary of the discovery by Charles Martin Hall of a practical process for the manufacture of aluminum. Hall was young—only twenty-two—at the time of this achievement. The metal that he so cheapened as to make its use in industry feasible economically was then already "old." Approximately sixty years had passed since the experiments of Oersted and Wöhler had made aluminum visible to the eye of man and available for further direct work upon it, and almost eighty years since Davy had pointed to its existence and given it, unseen, a name. A step toward the commercialization of the metal had indeed been taken some thirty years before by St. Claire Deville, who actually introduced aluminum to the public and "put it on the market," though at a price that greatly limited its use. And in the very year of Hall's discovery, Castner, by finding a cheaper way of making the metal sodium, required in the St. Claire Deville process, reduced the price of aluminum to a fraction of its previous cost. But the existing plants for the metal's manufacture were almost immediately made obsolete by Hall's invention.

This, to quote Edwards, consisted in "the discovery of a fused electrolyte which would dissolve substantial quantities of alumina and which possessed a higher stability than the alumina, so that the latter could be electrochemically decomposed without affecting the solvent." This was the solution of a problem that had baffled many chemists, and now was solved by an Oberlin graduate in the year following that in which he won his sheepskin. And despite improvements since effected, the process used in making the aluminum turned out today in ever-increasing quantities by the great company of Pittsburgh, its subsidiaries and affiliates, is essentially Hall's.

Had a knowledge of this metal accompanied that of bronze and iron during the centuries that these were known to man, the boon gained through its use might now escape attention, lost in the commonplace. Had the knowledge, on the other hand, come suddenly and aluminum become quickly available to the manufacturer of equipment, the newly realized possibilities of lightening the weight of this equipment would have seemed like those to be attained in fancy by its imagined transfer to a planet of smaller mass where things would weigh less. As it is, the development of the aluminum industry has progressed more slowly, due in part to the unawareness of equipment manufacturers and their customers to the opportunities before them.

At last the public is awake; it now knows its aluminum. The use of the metal and its alloys wherever practicable in the design of mine and plant equipment is now not only recognized as sensible and advantageous from the engineering viewpoint, but it is also strictly fashionable. Builders of equipment will now remember, too, that the metal makes a marvelous paint, unsurpassed for its ability to cover efficiently and attractively whatever construction material has been used, and, by its reflective power, to aid effectively in lighting plant interiors.

Modernizing the Patent System

INTIMATION that in some respects our patent system has not emerged from horse-and-buggy days is contained in the second report of the Science Advisory Board to the President. Viewing the primary purpose of the patent system as the stimulation of new industries, a committee of the board considers what might be done to the system itself to bring it into harmony with this streamlined age. If the system is to continue to be a primary influence in shaping American industrial life, perhaps it ought to be remodeled to meet modern conditions. Recommendations to this end merit attention.

In the first place the committee was struck with the enormous number of patents granted—90,000 a year—many of which, for triviality and low standard of invention, should never be issued. With such a mass of patents claiming the attention of examiners, it is not surprising that the mere issuance of a patent is no proof of its validity. In order to insure, or at least enhance, this presumption, the committee recommends that when a patent is ready for allowance it be published in the Official Gazette, with an open invitation to interested parties to submit pertinent facts. Unless the patent could withstand further scrutiny by the examiner in the light of submitted facts, it would not issue.

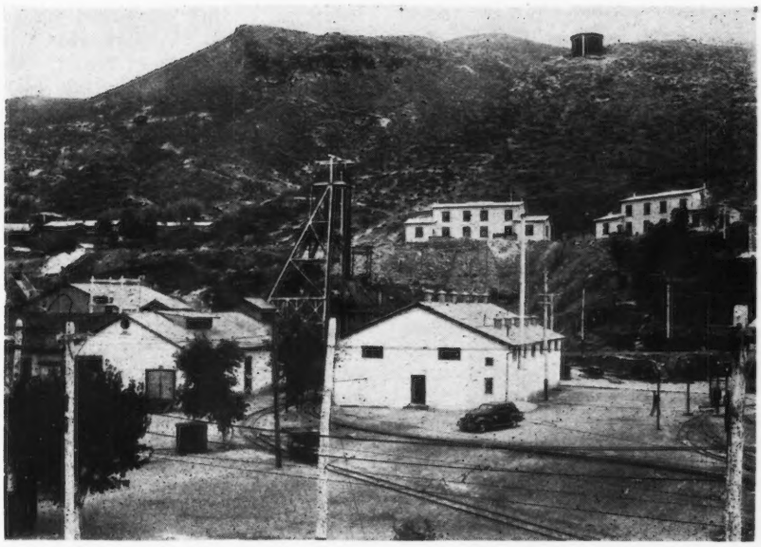
The delay, confusion, and cost of our present method of litigation of patents is the second major item to receive the committee's attention. As a remedy it recommends the establishment of a single Court for Patent Appeals, composed of judges having the necessary scientific or technical background and appointed for life. Closely related to this recommendation is a third, that scientific or technical advisors or juries be provided to assist courts of first instance in equity patent causes. There are other minor recommendations, but the foregoing three are considered most important and may receive the attention of Congress this year.

Mining in Mexico Today

Activities and Technical Practice in Some of the Principal Areas and Plants

A. H. Hubbell
Associate Editor

PART
· I ·
Santa Eulalia
Chihuahua
Santa Barbara
Parral



NO. 5 SHAFT HEADFRAME and patio of El Potosi Mining Company, at Santo Domingo. The tracks in the foreground connect the shaft with receiving bins (not shown) to the right of the picture. This view was taken from the office, which is somewhat higher than the patio. The elevation of the latter is 6,030 ft. No. 5 is 2,587 ft. deep

El Potosi
Premier Producer of Lead

This single mine yielded
65,300 tons in 1935

JUST as Chihuahua has the largest lead smelter in Mexico if not in the world, the mine of El Potosi Mining Company, in the Santa Eulalia district, 16 miles east of the city of Chihuahua, is the Republic's largest single producer of lead, in point of output. In 1935 its production of this metal was 65,300 tons. Mine plant, offices, and the residence of the superintendent, Harlan A. Walker, are at the compact camp of Santo Domingo, shown on the next page, and situated in a canyon of the Santa Eulalia Range a little above the old town of Santa Eulalia, of 9,000 population. Santo Domingo's elevation is about 6,000 ft. The Santa Eulalia district, some 9 miles long by 7 wide, includes the greater part of the range. Four miles nearer the city, at San Guillermo, and 6 miles from the mine, is the company's selective flotation plant, which handles the mine production of 2,200 tons of ore. The mill superintendent, C. A. Mehring, is resident here, close by the plant. The general offices of the company, including that of E. P. Ryan, the general manager, are at the Hacienda Robinson, 3 miles from the center of the city.

El Potosi's mine is linked with the mill at San Guillermo, and both are connected with the National Railways at Hacienda Robinson, by the company's own railroad, 30-in. in gage and 16 miles in length and electrified since 1925. A branch connects this with the Chihuahua smelter, a few miles away. Santa Eulalia is also connected with the latter by the Chihuahua Mineral Railroad.

The present company owns the entire stock of an earlier company known as the Chihuahua Mining Company, the two having had adjacent holdings. Of the company's present shafts, that known as No. 1 is in El Potosi ground, and No. 5 shaft, the headframe of which is shown in the illustration above, is in what formerly was the Chihuahua area.

The ore occurs as replacement deposits in the limestones that form the principal rock of the region, underlying a volcanic capping. They carry lead, silver, and zinc as well as considerable iron, and are found both as mantos and as chimneys, often of such size as to yield continuous stopes of large dimensions, horizontally and vertically. Frac-

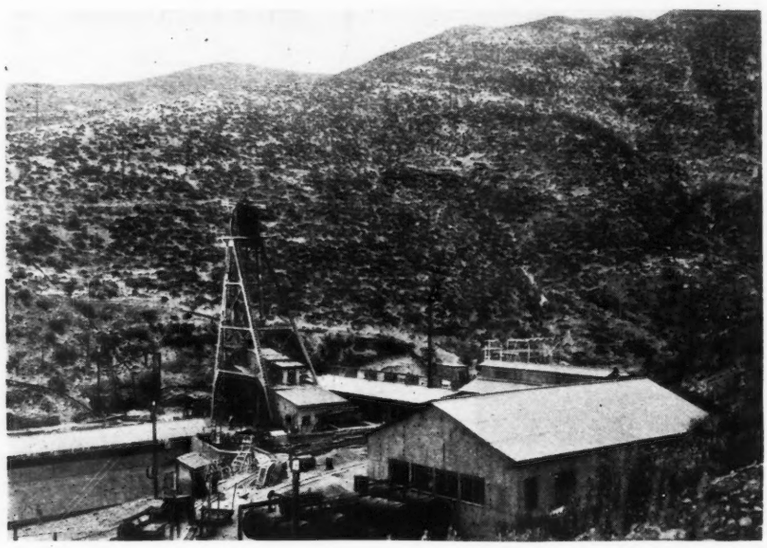
tures, both pre-mineral and post-mineral, are common, the former having obviously had some influence on deposition, serving as ore channels, especially where the trend is north. Certain of the limestone beds and of these fracture systems are favored by the mantos.

Both oxidized and sulphide ores have been found, the earlier tonnage having consisted of the oxides, whereas today, with production coming from the lower levels, the tonnage is almost wholly made up of sulphides. The depth of oxidation is irregular, thanks to the influence of the more recent fissures. In places, it extends to 1,400 ft. A typical analysis of the sulphides now being mined is: 10 to 11 per cent lead, 11 per cent zinc, with 8 to 10 oz. of silver and 28 per cent iron, the sulphur being slightly less. The silver occurs mainly with the lead, the latter as galena. The zinc is in the form of marmatite, presenting a problem in concentration. Iron comes as crystallized pyrrhotite of medium grain, with pyrite, the iron sulphides constituting a third or more of the ore by weight.

The property is opened by three shafts, the aforesaid No. 1 and No. 5, and also the newer No. 3. Elevations of their collars respectively are 6,030, 6,030 and 6,100 ft. Nos. 1 and 5 were located years ago before the extent of the deposits was known. Happily they proved to be in one of the major systems. They are at the west side of the rather irregular-shaped tract of 84 pertenencias, totaling some 408 acres, and are about 1,100 ft. apart, No. 5 being approximately north of No. 1. Almost due east of No. 1 and about 1,800 ft. away is No. 3 shaft, which was sunk three or four years ago. In depth these three shafts, in numerical order, are respectively 2,777, 2,235, and 2,587 ft. Greatest depth attained by workings is about 3,000 ft. Limestone continues below the workings as shown by diamond drilling. No. 5 shaft is sunk from the patio level. No. 3, an interior shaft, now used only for ventilation, was sunk at the patio elevation from the old main haulage tunnel. No. 1's collar is 65 ft. higher than the collars of the other two.

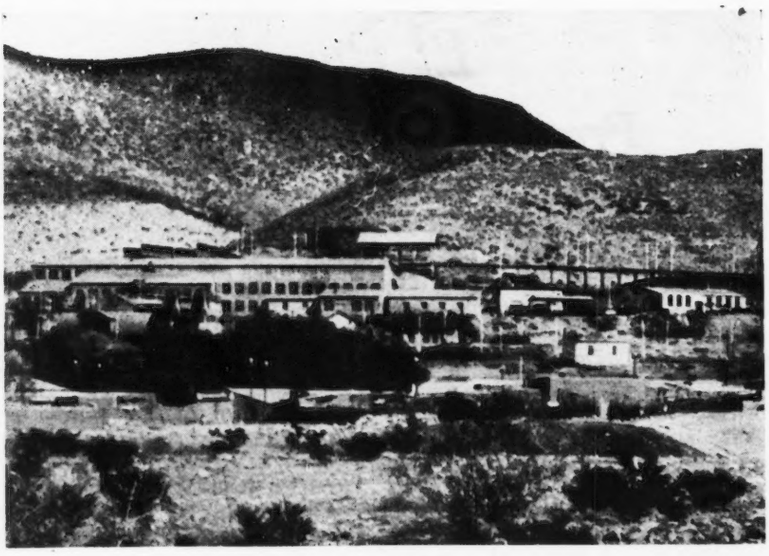
Dimensions of the shafts, in the same order as before, are 8x17 ft., 7½x16½, and 7½x15 ft. respectively. Each has two skip compartments, 4x5 ft. in cross-section in Nos. 1 and 3, and 3 ft. 8 in. x5 ft. in No. 5; also a manway that is 5x5 ft. in the first two and 4x5 ft. in No. 5.

Certain features stand out in any in-



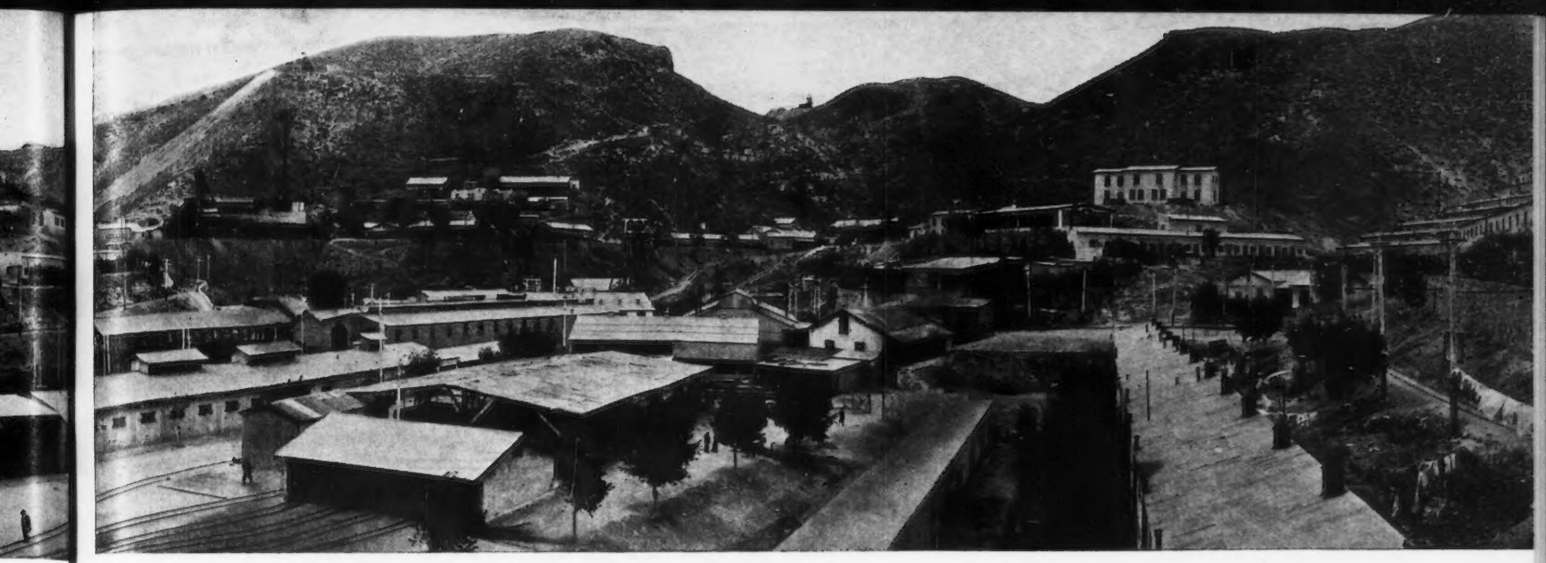
EL POTOSI NO. 1 SHAFT

2,777 ft. deep and 1,100 ft. south of No. 5. Picking belt building and receiving bins at left. Hoist house at right. This shaft is used for hoisting men and ore, the latter being dumped into an underground bin that discharges into cars that are run in to its chutes through a short tunnel a little below the collar



SELECTIVE FLOTATION PLANT

at San Guillermo, 6 miles from the mine. It handles daily 2,200 tons of ore, from which it produces 340 tons of lead concentrates, and a like amount of zinc concentrates



CAMP OF SANTO DOMINGO, IN THE SANTA EULALIA DISTRICT

This panorama covers a half circle approximately. In the center is El Potosi's patio, from which the No. 5 shaft is sunk; also the receiving bins for this shaft, the mine offices, and shops. On the bench above the buildings is the headframe of the Buena Tierra Mining Company, under lease to American Smelting & Refining Company. At the extreme left of the picture can be seen the playground of a school recently provided by El Potosi

spection of El Potosi's underground operations. First, the ground stands well, permitting the working of the orebodies in unsupported open stopes that are often of huge dimensions. Second, little water has to be handled. The flow from all workings totals only 25 g.p.m., this being used on top for toilets and gardens. To provide sufficient water for drilling and other operations, an additional 75 g.p.m. is pumped at 1,100-lb. pressure from Hacienda Robinson through an 11-mile 4-in. pipe line. Some of this is given to the town of Santa Eulalia. Third, a large amount of electric power is used underground, due principally to the use of scrapers for mucking ore. Mechanization of this operation has afforded a great saving. Fourth, the practice of making time studies of operations has been followed, giving a large amount of useful data.

Exploration is done by drifts and crosscuts, winzes and raises, the three shafts serving as centers for such work. In addition, diamond drilling from the headings thus driven is extensively used. Seven drills are kept continuously in service, five being driven electrically and two by air. Several others are maintained in reserve. Those in use include Longyear and Sullivan machines for the most part, there being among them three small Longyear "Prospectors," good for 250 ft. of hole, and one air-driven Mitchell. The latter and the "Prospectors" are one-man machines, with which an attempt is being made to use 10-ft. instead of 5-ft. rods, this necessitating widening the heading but being on the whole cheaper because of the greater speed.

The geological data thus obtained aid not only in the discovery of new ore but in planning the ore extraction and in calculation of reserves. For the latter work a factor of 10 cu.ft. per ton has been used in the sulphide areas in the upper levels, as against 13 for carbonate ore. Lower down, 8 cu.ft. is being used in estimating sulphide tonnage. In bookkeeping here the exploration and development account is made to include the diamond drilling. In calculating detailed costs, however, a distinction is made, in that drifting, winzing, and sinking and raising done in limestone are considered exploration, whereas the same work in ore is classed as development. The amount of development work required per ton of ore is exceedingly variable. In recent years it has been approximately 1 ft. for every 30 tons of ore mined.

Level intervals of 165 ft. are now used, compared with 100-ft. intervals once employed. This serves to reduce the amount of development work required for reaching the ore, which is large, as already pointed out, on account of the irregular shape of the deposits. Drifts, winzes, and raises are driven 5x7 ft. in cross-section, with an 18-hole round that, in drifts, breaks 3 to 4 ft.

Local conditions have controlled the selection of the stoping method. As previously said, the irregular orebodies vary much in size and attitude, ranging from wide chimneys and thick mantos to deposits that may be small and flat. The wide and more or less vertical bodies and the thick horizontal ones, in view of the way in which the walls stand unsupported, have lent themselves admirably to extraction by underhand stoping in benches, around central raises, to which most of the ore falls by gravity, the remainder being readily moved by scrapers. In the smaller horizontal deposits, breast stoping with perhaps a single bench is used, mucking being done by hand into cars or by scrapers into chutes. The sulphides oxidize too readily to permit a method that would call for holding the broken ore long in stopes. Stringers, moreover, must be followed religiously in the hope of finding new ore, and the mining method must facilitate this work.

In opening a chimney-type deposit of great vertical extent, its limits are first determined by drifting and crosscutting through it on two levels, or, if necessary, from a third higher level or from nearby workings. This done, the upper contact with the limestone is ascertained by raising, and the machine men begin stripping the ore against it. The glory hole is started by benching around the extraction raise which delivers to the haulage level below, the ore passing over a grizzly in a bulldozing chamber 25 ft. above the level. Grizzly and the chute raise beneath it are offset sufficiently from the extraction raise above the chamber to permit the ore to slide to the grizzly without cutting off the passage of air through the extraction raise which serves for ventilation. At the opposite end of the chamber is a manway raise, parallel with and about 15 ft. from the chute raise. The glory holes are entered from above.

Similarly, in preparing to mine a large manto, its extent and direction are first determined, an extraction drift is run beneath it, and from this similar extraction raises are put up to the ore above. In large stopes, cribs are occasionally used to support a great expanse of back.

Benches 6 ft. wide and 6 ft. high are cut in glory holing to avoid breaking the large slabs that experience has shown would be produced by long drill holes. Jackhammers are used in stoping, being cheaper and more convenient for the purpose than other machines. Stopers are used for raising. Only wet drilling is employed. One-inch hollow-round steel is used for all drilling operations.

Drills are selected after comparative underground tests, to determine not only relative performance but also the best air pressure at the drill. A machine that will drill soft rock well at a pressure somewhat less than that usually employed is sought.

For blasting in stopes, Apcodyne dynamite is used, a high-count powder running 160 to 170 1⅛-in. sticks per 50-lb. case. This is the equivalent of 40 per

cent gelatin, and is said to shatter better and to make more fines. It costs somewhat more than that previously used, but it is cheaper in the end, because of the higher count. It also makes more gas, which is said to matter little, on account of the large size of most of the stopes. In development work, straight 40 per cent gelatin is employed, this to reduce the gas. Blasting caps are of 6X strength, used with ordinary fuse. In sinking shafts and wet winzes some electric delays are furnished, blasting being done from the power line in the case of shafts and from blasting machines in remote spots. Primers are usually put at the bottom of the charge with the cap at the bottom and pointing toward the collar. All holes are tamped.

Scraping is extensively practiced, with hoe-type scrapers and Sullivan double- and triple-drum electric hoists, ranging from 7½ to 15 hp. and driven by 440-volt a.c. motors. The three-drum hoist is preferred, because of the larger area that can be mucked from one position. Scraping distance averages 100 to 125 ft., and is occasionally as much as 150 ft. Pull and tail ropes are of ⅝-in. salvaged hoisting rope.

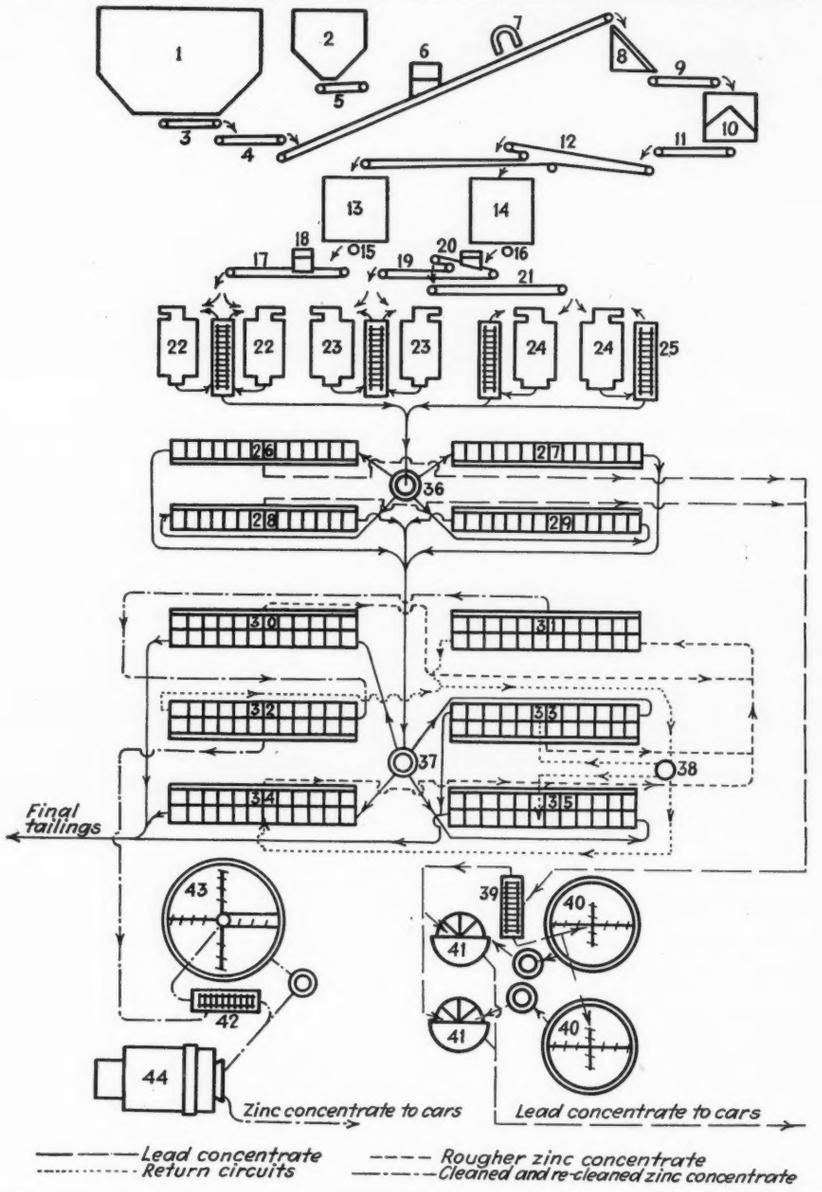
An Eimco-Finlay loader has been used for mucking in headings and to a limited extent in stopes. Scrapers, however, are better adapted to the mining system and have the local advantage of being electric-powered.

Tons broken per man-shift during 1935 up to the early part of December averaged 6.067 metric tons of ore, or 6.689 tons counting ore and waste, for contract labor. The corresponding figures for total underground labor are 4.40 and 4.90 tons respectively. Based on the entire operation, exclusive of construction work, the figures are 1.911 and 2.106 tons respectively. These are calculated for an output of 479,816 tons of ore and 49,194 tons of waste.

Ore is hauled to the shaft pockets in Park-Utah type gable-bottom cars, of 57-cu.ft. capacity, by Mancha storage-battery locomotives equipped with Edison batteries. The cars were made from Park-Utah blueprints, the only change being the substitution of Man-Ten steel of the same gage for making the bodies, thus securing increased ruggedness. Tracks are of 18-in. gage and are laid with 20-lb. rails—in some cases 30-lb.

Hoisting is done only at Nos. 1 and 5 shafts, both hoists being double-drum second-motion units of Allis-Chalmers make. The former has 8-ft. diameter drums of 6½-ft. grooved face and is driven by a 700-hp., 425-r.p.m., 550-volt d.c. motor, supplied from a motor-generator set. It has a 16-ton flywheel to handle peak loads. No. 5 has 7x6-ft. drums and a 25,000-lb. flywheel. Both hoists have friction clutches and are equipped with safety devices. Four-ton (dry tons) skips are used at No. 1, and 3-ton skips at No. 5 shaft. Men are hoisted by cage.

The ore and waste hoisted at No. 1



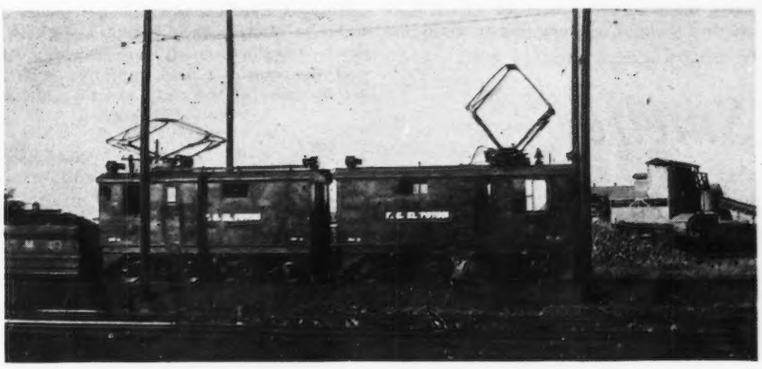
EL POTOSI'S FLOWSHEET

used in mill at San Guillermo, 12 miles from city of Chihuahua. Selective flotation of the lead and zinc is practiced, the iron being thrown into the tails

LEGEND

1 and 2. Coarse ore bins. Capacity, 3,100 tons
3 and 5. Apron feeders
4. Conveyor
6. Weightometer
7. Magnet
8. Hum-mer screen. Opening ¼x¾ in.
9. Conveyor
10. 5½-ft. Symons cone, —⅝ in.
11 and 12. Belts
13 and 14. Fine-ore bins. Capacity, 840 tons
15 and 16. Drum feeders
17, 19, 21. Fine-ore conveyors
18 and 20. Weightometers
22 and 23. Cole-Bergman rod mills, 6x12 ft. Two duplex Dorr classifiers, 5 ft. 10 in. x 23 ft. 4 in.
24. Two 5x12-ft. Marcy rod mills
25. Two duplex Dorr classifiers, 5 ft. 6 in. x 22 ft. 8 in.
26, 27, 28, and 29. Minerals-Separation Sub A machines 14-cell, 18-in. Tex-rope-driven
30, 33, 34, and 35. Minerals-Separation Standard machines 14-cell, 24-in. zinc roughers
31. Zinc cleaner
32. Zinc re-cleaner
36. Lead distributor
37. Zinc distributor
38. Distributor of tails from cleaners
39. Dorr classifier, 2 ft. 6 in. x 14 ft. to take coarse lead direct to filters, so that the thickener can be worked
40. Two 30x10-ft. Dorr thickeners
41. Two 6-ft. 4-leaf American filters, about 175 tons on each. From filters to cars by 16-in. conveyor. Four-inch Dorrco pumps between thickeners and filters
42. Dorr classifier, similar in purpose to 39
43. Dorr traction thickener, 45x6 ft. From thickener to cars
44. Dorrco 8x12-ft. filter. Has handled as high as 550 tons per 24 hours.

shaft is crushed to 3 in. in a 36x24-in. Blake-type crusher, and conveyed thence by belt to railroad bins. At No. 5, ore is delivered to a similar crusher above another set of railroad bins 300 ft. away by a Jeffrey trolley locomotive. Combined storage capacity of these bins is 8,000 tons of ore. From these the ore is loaded into 17-ton steel railroad cars which are hauled in trains to the mill at San Guillermo by the company's own electric locomotives. These are 25-ton G.E. units and are coupled in tandem for the haul to the mill at San Guillermo and from the latter, with concentrates, to the Avalos smelter. A remarkably low transportation cost is thus obtained.



25-TON ELECTRIC LOCOMOTIVES

coupled in tandem, haul ore on El Potosi's own railroad from mine to mill, and concentrates from mill to the National Railways at Hacienda Robinson, for shipment. A very low per ton-mile cost is achieved

The electrification of the road was described by Mr. Walker in *Engineering and Mining Journal* of Feb. 23, 1929. The cost per ton-mile for ore and freight as given then was only 2.13c., a figure that is probably close to the cost at present. Mr. Walker is also the author of a detailed paper on the mining practice published in 1933. This has been of some help in preparing the foregoing, although much has been added regarding the recent practice as observed on an underground trip with Mr. Walker.

Concentration practice at the San Guillermo selective flotation plant has also been described in a paper written jointly by Mr. Mehring, F. J. Bacon, then plant metallurgist (Donald R. Slessinger is now plant metallurgist), and Oba Wiser, consulting metallurgist for the company. This is now some three years old. Since it was written, the flowsheet has undergone certain changes, as is usual with flowsheets. However, by the time this information was collected, the mill had returned to the practice described in the paper, so that the flowsheet now used, which is reproduced here, is essentially like the one showing the practice of 1932 described in the paper. The tonnage today is larger than that treated in 1932.

The mill, which is running on three eight-hour shifts five days per week, is handling 2,200 metric tons per day of sulphide ore of the following approximate analysis: Lead, 10.85 per cent; silver, 8.2 oz.; zinc, 10.40 per cent; iron, 29.5; sulphur, 24.9; lime, 6.6; and insoluble, 5. Only a trace of gold is found. Silver is associated with the lead, only a little of it being in the zinc. Iron is mostly pyrrhotite, and the remainder pyrite. Lead occurs as galena and the zinc as marmatite, an iron-bearing zinc sulphide, which when pure contains 49 per cent zinc and 14.9 per cent iron. Recoveries for the first eleven months of 1935 were: Silver, 90.46 per cent; lead, 96.05 per cent; and zinc, 71.72 per cent.

All-flotation is practiced, with selective separation of the sulphide minerals. The ore, crushed to minus 3-in. ring size, at the mine, is screened and the oversize is crushed to minus $\frac{3}{8}$ in. in a Symons cone, the product with the screen undersize going to the fine-ore bins. The feed from these is divided among two pairs of Cole-Bergman rod mills, each pair in closed circuit with one classifier, and a third pair, consisting of Marcy rod mills, each of these being in closed circuit with a classifier. Overflows of all four classifiers are joined and then divided among four M-S Sub A machines, which make a final lead concentrate, that is thickened, filtered, and shipped. An approximate analysis is: 64.50 per cent lead, 42 oz. of silver, 4.5 per cent zinc, and 8 per cent iron. Reagents used in the lead circuit will be mentioned later.

Tailing from the lead machines is joined and divided among four rougher M-S Standard machines, modified to cause circulation of the feed within the cell. These make a zinc concentrate that is cleaned on a separate M-S machine, the concentrate of which is re-cleaned on still another M-S unit. The tailings of both cleaner and re-cleaner are returned to two of four zinc roughers. Those of the roughers go to the dam. The re-cleaned zinc concentrates go to a rake classifier to remove the coarser material, the overflow of this being thickened and combined with the sands and then filtered and shipped. This zinc concentrate runs approximately 48 per cent zinc, 15 per cent iron, and 1.30 oz. of silver. The chief difficulty in this circuit is to keep the pyrrhotite out of the zinc.

From 2,200 tons of feed, approximately 340 tons of lead concentrate and the same amount of zinc concentrate are produced. The ratio of concentration for each metal and for the whole tonnage is $6\frac{1}{2}$ to 1.

Reagents used today are somewhat different from those employed in 1932. In pounds per ton, they are as follows: No. 5 pine oil, 0.039, and lime, 0.47, both figured on the total tonnage; American Cyanamid, 0.69, and Minerec B, 0.054, both figured on the lead; potassium ethyl xanthate, 0.034, and copper sulphate, 0.77, both figured on the zinc; and sodium cyanide, 0.044, figured on the lead and zinc. As for the lime, a pH of 8 to 8.1 is maintained in the mill circuit. Geary reagent feeders are used.

Impellers of the M-S Standard machines are of cruciform type and are screwed on instead of keyed. They are alternately provided with right- and left-hand threads so as to equalize the thrust on the driving gear. The M-S Sub A machines have inclosed impellers.

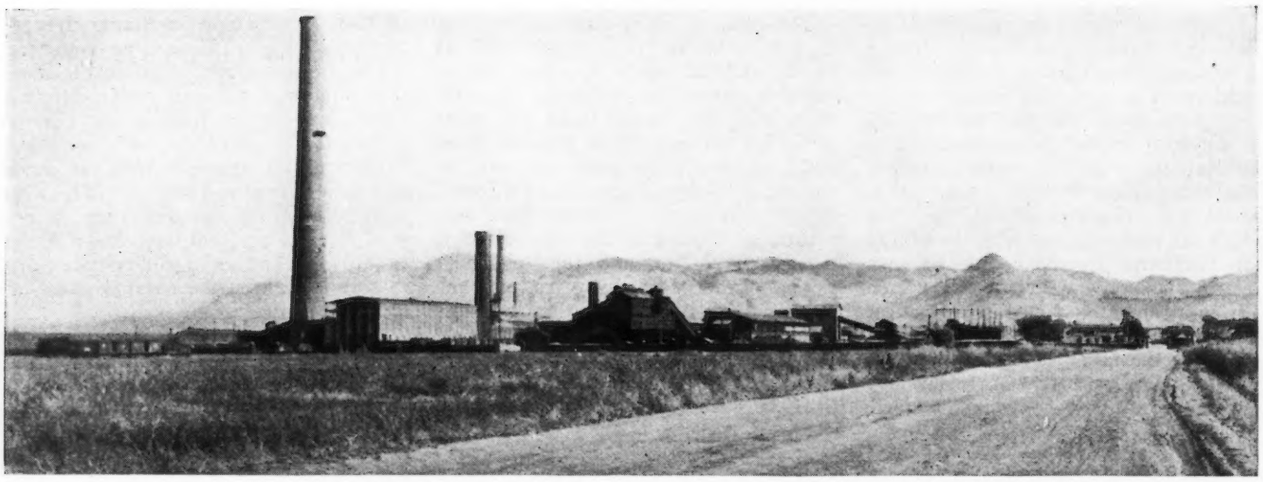
Pulp dilutions are approximately as follows: grinding mills, 78 to 80 per cent solids; classifier overflow to flotation, 46.5 per cent solids; and thickener underflow, as thick as can be pumped, about 75 to 80 per cent solids.

Rod loads are: Cole mills, 22.5 tons; Marcy mills, 15 tons. Iron consumption is 0.4998 lb. per short ton ground. Speed of the Cole mills is 15.1 r.p.m.; of the Marcy mills, 21.1 r.p.m. Each mill takes a 125-hp. motor.

Mill tailings during 1935 ran 0.5 per cent lead, 3 per cent zinc, and about an ounce of silver, with iron running about 39 to 40 per cent. Tailings sent to the dam are split between three 6-in. Wilfley pumps, which pump them through 6-in. iron pipe lines provided with spigots at intervals for spilling. Eventually there will be three dams. On Dec. 1 last there was 2,300,000 tons of tailings on the dump.

Mill-water supply of 400 g.p.m. is obtained from Hacienda Robinson through an 8-in. line against a 500-lb. head. Mill consumption actually runs 342 gal. per ton. Of this, in the month of November last, 67 per cent was new water and the remainder return water.

Eleven men are employed in the mill per shift. In addition, there is a shift boss. Of the eleven two are on the crushers, two on the rod mills, two on flotation machines, one man is on the sampler, and four men are on the filters.



THE CHIHUAHUA SMELTER, or, officially, the Avalos plant of the American Smelting & Refining Company, is situated 6 miles from the city on the road leading to the Santa Eulalia mining district. From left to right the major structures that can be seen are: the stack, the baghouses, the sintering plant, and the crushing and sampling plant. In the distance at the right are the offices and residential section

The Avalos Smelter,

Near Chihuahua

Largest lead plant in the world . . . Approximate output 500 tons per day

SOME FIVE MILES or so outside the city of Chihuahua is the largest lead smelter in the world, output of the metal considered, this now amounting to about 500 tons of bullion daily. It is known by several names—the Chihuahua smelter; the Morse plant, called "Mor-say" in the Mexican style, after the local railroad station; and the Avalos unit of the American Smelting & Refining Company, the last, accented on the first syllable, being its official name. And the reader must not confuse it with the Avalos mining unit of the Peñoles company in Zacatecas, something naturally very different. As becomes a smelter, it has ample rail facilities. Four roads serve it, varying in dignity from the line of the National Railways, running from Mexico City to El Paso, and the Northwestern of Mexico, to the Chihuahua Mineral Railroad (F. C. Mineral de Chihuahua), which connects Santa Eulalia camp with Chihuahua City, and the El Potosi Mining Company's electrified narrow-gage line, which links the latter company's famous mine, 10 miles away, close to Santa Eulalia, and its much nearer San Guillermo mill, with the smelter.

The reduction plant, with its adjacent residential sections for those staff members and workmen who choose to live close by, occupies a level site of about 1,078 acres lying east and west on a stretch of plain, wholly cut off from sight of the city by a range of hills and with nothing on the horizon to look at save other hills. The site was purchased in 1905. The general elevation of this area is 4,700 ft.—about 100 ft. higher than that of Chihuahua city itself. Here at Avalos 5,000 people live, including the 1,200 men on the company's payroll and their families. The force required for three-shift operation is only one thousand men, but 20 per cent more than this is needed to take care of the seventh day, no man working more than six, as well as to replace those who are ill or on vacation. Besides the living quarters, the appendages include a vocational night school, a movie theater, syndicate headquarters, and a post office. L. B. Harrison is manager of the smelter and R. C. Rutherford assistant manager.

About 65 per cent of the tonnage smelted is lead concentrate, most of this coming from the El Potosi company's mill and from the smelting company's operations at Parral and Santa Barbara, in the southern part of the State, plus a small tonnage from other scattered mines. The remaining 35 per cent consists of limy and carbonate ores and residues from the company's zinc plant at Rosita, in Coahuila, and of late a fair tonnage of gold ores from miscellaneous properties.

Crude ore received is unloaded onto a 42-in. belt, which delivers over a grizzly to one of two No. 7½ gyratories that can be set to about minus 2 in. This discharge goes by conveyor to an automatic sampling plant. After the sample has been cut the reject passes to another building, where it is further crushed in a 4-ft. Symons cone and passed to a Leahy screen, the oversize going to 54x20-in. Garfield rolls. From here it goes to the bins, whence, with the concentrates, it goes to storage. Fine ore and direct-smelting ore are bedded separately.

The Dwight-Lloyd sintering plant comprises twelve 42-in. machines, seven 22 ft. long and five 47 ft. These are oil-fired with Rickard muffles. Eight of them are on first-over, or first roast; three are normally on final roast, with one as a standby. On the first-over machines a 2¼- to 4-in. depth of bed is carried, depending on the character of the charge, and a 10-in. bed on the final-roast machines. Charge fed to the first-over machines, including the diluent, is 10.5 per cent in sulphur; that to the final machines 5 to 5.5 per cent. As finally discharged, the sinter runs 1 per cent sulphur. The small machines, on first-over, will handle 150 tons per day. Capacity of those on final-over is 500 tons daily. The charge being finer on the first-over machines, it is harder to get air through. On each of the large machines a 72x15-in. fan driven by a 150-hp. motor is used, and a 66x10-in. fan and a 75-hp. motor on each small one.

First-over sinter, on discharge, passes into a bin with an arc gate, whence it is loaded into 10-ton cars and transferred to the sinter crushing plant, where it is passed through Cornish rolls followed by a 16x42-in. set of smooth rolls, whence it goes to tank storage. From here it is taken as needed by conveyor to the hoppers above the final machines. The final-roast sinter discharges to a hopper in front of each machine, and then goes to the weigh hopper and the blast furnace.

The sinter department baghouse has seventeen sections, of 122 18-in. x 32-ft. woolen bags each, the bags being shaken mechanically. A pressure ranging up to

3.5 to 4 in. before shaking is used, in contrast to practice in the United States, where with a big fan the pressure rarely exceeds 1½ in. Each section has an individual fan, made by American Blower Company and capable of building up this pressure. This system requires more power per section, but fewer sections, on account of the higher pressure. Each fan is driven by a specially built 30-hp. United States motor. The motors are controlled by pushbuttons from above, so that the workman there can shut them down before shaking. A skin of gunite on the metal flues leading from the fans to the bags has been found to increase their life.

Life of the bags under the stated conditions is nine months to two years, averaging fifteen months. One asbestos bag is being tried experimentally. Could the gases be sent through hot, instead of being cooled with water sprays, as now, from 325 deg. F., on leaving the machines, to not over 190 deg. F. at the bags, the stack capacity would be greatly increased.

Sinter dust is returned to the sintering department.

Composition of the sinter beds is such as to afford a balanced charge for the blast furnaces. If need be these could run entirely on sinter. Charges of two respective compositions are used: Potosi, 40 to 42 per cent lead, quite clean, with no bismuth; and Parral and Santa Barbara, about 30 per cent, higher in copper and carrying bismuth. The furnaces are normally run on one charge one month while accumulating material for the other, and vice versa, the tonnage being about equally divided.

A charge is made up for the furnaces with the aid of a weigh-hopper reclaiming car, this taking sinter and coarse ore from their respective beds and lime as required, and delivering these materials through hatchways to the charge car. The weigh hopper is checked once a shift on a track scale.

Coke, from Rosita, is transferred to a 1,000-ton bin on arrival, whence it is drawn into coke buggies which dump into the charge car. Up to 3 or 4 per cent of scrap iron is also being used. Of this there is some 1,500 tons on hand. Clean-up from the furnaces is added, a little at a time. The charge car, which has a drop bottom, is then hoisted up on the furnace.

Of the eight blast furnaces, four were operating and three were serving as standbys at the end of the year. The eighth was being rebuilt. The furnaces are 202x46 in. at the tuyeres, of which there are 30 per furnace. From bottom to top of furnace is 28 ft., the active ore column being 21 ft. Thimble tops are used.

Tonnage handled per furnace varies from 300 to 400 metric tons of (cost) charge per day, averaging 340 per day in November. Two settlers are used per furnace. Lead wells have been abandoned.

Lead tapped from the settlers is transferred by crane to the drossing plant, which is equipped with four 100-ton kettles, two of 65-ton and two of 35-ton capacity. Dross removed from the kettles by a mechanical skimmer is charged with a little silica to a 7x21-ft. reverberatory, the products being lead, speiss, and slag.

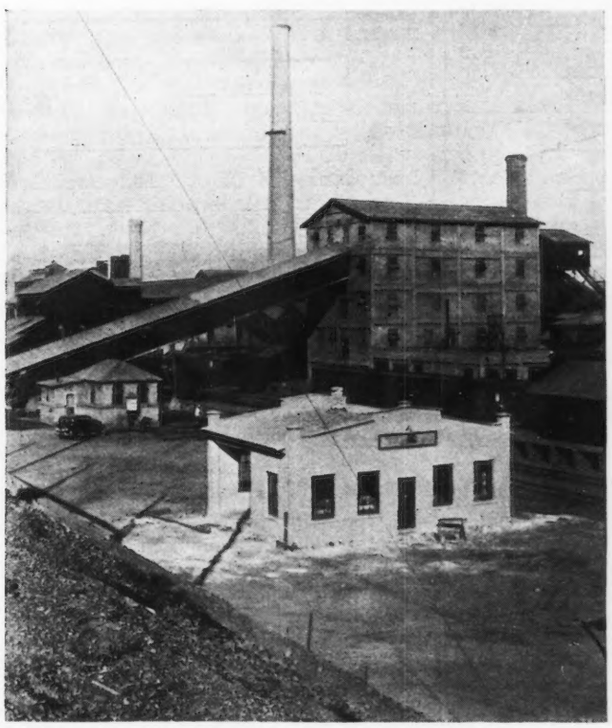
The lead charged into the first kettle overflows into a lower one adjacent, from which it is pumped into the third kettle and cooled to about 630 to 650 deg. F. This brings out the last of the copper, leaving only 0.05 per cent in the lead. The black dross is skimmed. The lead is then heated up to 750 deg. F. or better and pumped into the casting kettle and sampled by taking small buttons. Thence it goes to a straight-line casting machine and is cast into 48-kg. bars. This machine will cast 100 tons of bullion in 2½ hours.

The bars resulting from the operation are lifted five at a time by a clamp and piston and stacked in piles of twenty, which are handled on Federal buggies. In November last, 14,000 tons of bullion was made in this manner.

A separate baghouse serves the furnaces. It has eleven sections, but is otherwise the same as the one that serves the sintering plant.

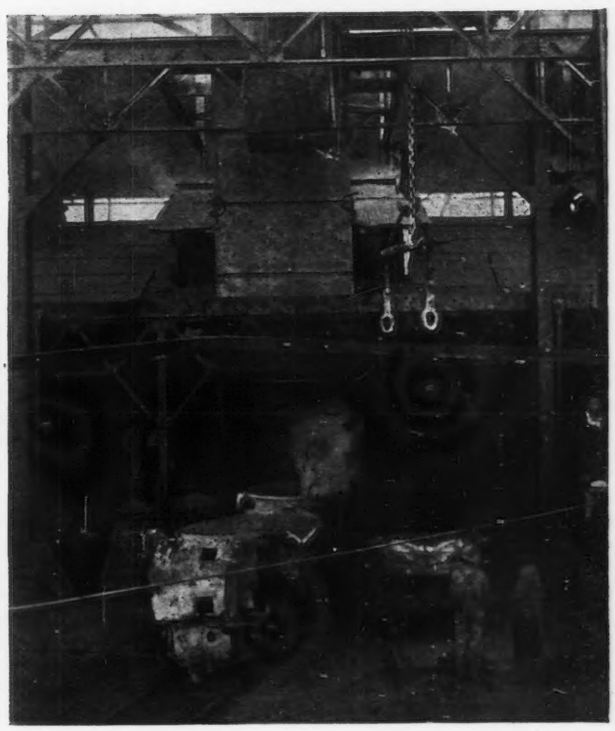
SAMPLING PLANT

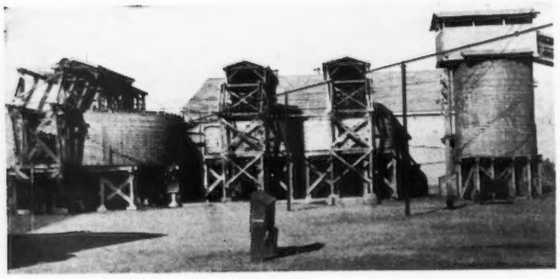
of the Chihuahua smelter. Here all crude ore received is crushed and sampled automatically. It then goes to receiving bins and from there to storage



AT THE BLAST FURNACES

The plant has eight of these. They are 202 x 46 in. at the tuyeres and are equipped with thimble tops. Four were in service at the year's end





THE TIN CONCENTRATOR stands within the wall of the Chihuahua smelter. Here are seen, from left to right, the primary thickener, two small thickeners for dewatering middlings, and the fine-ore bins

Milling Tin Ore From the San Antonio Mine

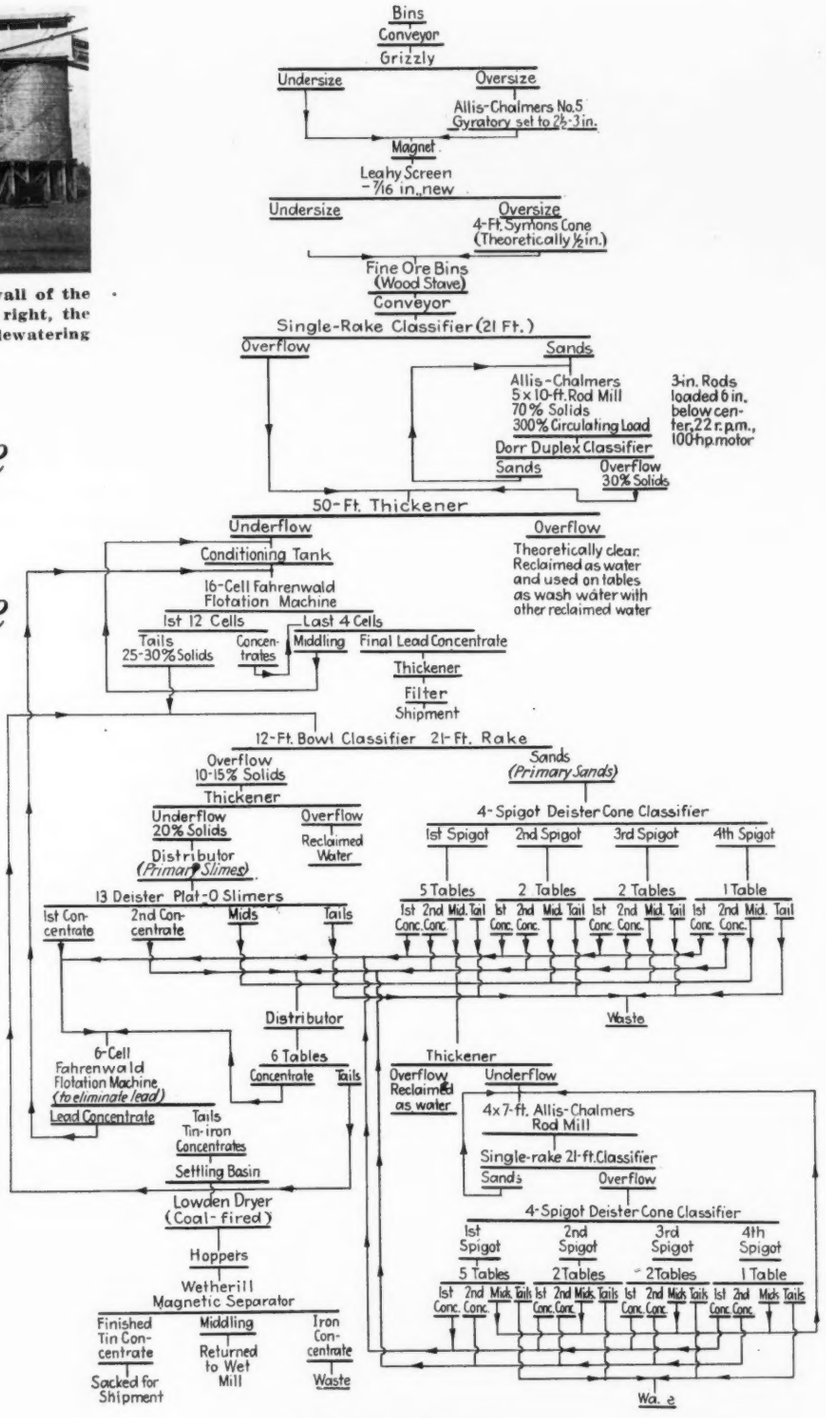
Tabling and flotation, plus magnetic separation, are used in treating 200 tons per day

WITHIN THE ADOBE WALL that incloses the buildings of the Avalos smelter, and at the east end of the 1,078-acre tract, is a concentrator that was started in the spring of 1930 to handle the lead-silver-tin ore from the company's San Antonio mine of its Santa Eulalia unit, 20 miles from the plant, mine and plant being linked by the Chihuahua Mineral Railroad. Save for a year and a half during the depression, the mill has operated steadily, treating 200 tons of ore per three-shift day.

An approximate analysis of this ore today is 12 per cent lead, 300 grams of silver, and half of 1 per cent tin, the other constituents being 15 to 20 per cent iron, 10 to 14 per cent lime, and 30 per cent insoluble. The lead is mostly in the form of carbonate, one-tenth, roughly, being plumbojarosite. The tin occurs as cassiterite. The half per cent of tin here set down represents a decided decrease in tin content, which at the start was 2½ to 3 per cent.

Treatment employed, after crushing, screening, and grinding, consists, in the main, of flotation and tabling, with such classification, thickening, and conditioning as are necessary. The tin-iron concentrate thus obtained is subsequently subjected to electromagnetic separation, yielding a finished tin concentrate and an iron tailing which is sent to waste. The accompanying flowsheet gives the details of the present method of treatment.

Recoveries achieved with the present heads are: Tin, approximately 35 per cent; lead and silver, each 85 per cent. Out of 200 tons of feed daily, this means a yield of about 35 tons of lead concentrate and from 0.5 to 1 ton of tin concentrate. Flotation reagents used are Na_2S, potassium ethyl xanthate, Aerofloat 25, pine oil, cresylic acid, and sodium silicate. The quantities used vary widely with the grade of feed.



SAN ANTONIO ORE

from the Santa Eulalia district and containing lead, silver, tin and iron, is concentrated by this flowsheet. The iron, finally separated from the tin by electromagnetic means, is wasted. The lead is in the form of carbonate and plumbojarosite

The mill force consists of twelve men and a shift boss on each of the three shifts. In addition, the plant has its own assay office and a repair force, so that the total number of employees is 90. C. M. Syner is in charge. Although it is within the smelter inclosure, this operation, as previously intimated, is part of the Santa Eulalia unit.

CERRO DE LA CRUZ looms over the housetops of the city of Parral. In and under it are the veins worked through the Prieta and Aguilereña shafts, the headframe of the latter of which is seen on the skyline at the left. Adjacent to and beyond this shaft are the sulphide flotation mill and the flotation-cyanide plant

Parral's Output

Mostly From Cerro de la Cruz

Palmilla and other outlying properties yield a moderate tonnage monthly

PARRAL, in southern Chihuahua and 56 miles west of the National Railway's main line running northward through the State, is the center, so to speak, of one of the most active mining districts of the Republic. Literally looming over the town itself are the mills and headframes and other surface plant of the Parral unit of the American Smelting & Refining Company, which stand midway on the slope of the abruptly rising Cerro de la Cruz—a five-minute uphill motor ride from the heart of the business district. A few miles out of town in various directions are scattered mines and prospects, one group of them owned by the Mexican Northern Mining & Railway Company and operated for the owners by the Cia. Minera Asarco as the Parral Consolidated unit. Near these is the same company's Veta Grande mine, now shut down. Twenty miles southwest by road—and somewhat farther by train—is Santa Barbara, one of Mexico's oldest cities and the scene of the operations of the Smelting Company's unit of that name. And on the other side of the mountains from Santa Barbara at San Francisco del Oro are the properties of San Francisco Mines of Mexico.

At the Parral unit the extensive scale of operations is largely a development of the last decade. Ten years ago the slope of Cerro de la Cruz was largely barren of the structures that now add to its conspicuousness. These include a lead-zinc flotation mill of 1,050 tons' daily capacity and a 350-ton flotation-cyanide plant. Between these two plants is thus divided the 1,400 tons of sulphide and siliceous ores hoisted daily from the mine. A. A. Brown is general superintendent of this unit and A. F. Horle assistant. C. L. Boeke is mill superintendent.

Several veins are being worked, the principal ones being the Prieta-Tajo system, yielding sulphides, and the Iguana group, from which comes a siliceous ore for cyaniding. These veins are all in andesite. In addition, the cyanide plant is receiving a moderate tonnage from the once famous Palmilla mine of the Parral Consolidated unit and from certain other properties.

Two shafts—the Prieta and Aguilereña, on the Cerro de la Cruz—serve the mine. The Prieta shaft, the lowest working level of which is at 1,200-ft. depth, serves for hoisting men, and the Aguilereña, adjacent to the mills and 1,400 ft. deep, is the ore-hoisting shaft. Sulphide ore is hoisted on the first and third shifts, and Iguana ore on the second. Skips are used. The Aguilereña shaft was sunk originally to work the Jesus Maria vein, much narrower than the Prieta and joining it to the north. On the Jesus Maria the bottom level is at 600 ft. The vein system on the property has a working length of about 1 km. Iguana's workings are connected by tunnel with the Prieta at the 800- and 1,200-ft. levels.

The sulphide ore is deposited in fissure veins from 10 to 125 ft. in width. Narrow places are worked by shrinkage stoping, the wide ones by an inclined cut-and-fill system developed locally. Or, to put it another way, shrinkage is used wherever possible, and when the wall gets bad, cut-and-fill is resorted to to avoid dilution.

An accompanying sketch demonstrates the principal features of the inclined cut-and-fill stoping method in its ideal form. In preparation, the first step is to drive a hanging-wall drift close to the wall but in the vein. Chute raises are then put up every 15 meters. A pillar 3½ meters thick is left and the stope is silled out above it, the first cut being 8 ft. high and the second one 6 to 8 ft. Scrapers are put in and the muck is moved to chutes. Fill raises are driven next, 30 meters apart center to center, by both sinking and raising, a raise being located either midway across the stope width or near the hanging. The stope above the sill floor is then filled with waste material, the ore having been scraped out.

Next, a footwall drift is driven, on the level, 2 to 3 meters within the solid, and footwall raises are put up at 30-meter intervals, opposite those points where the stope trenches through which the ore is drawn off are to be.

Trenches are then begun on top of the waste, connected at first with the chute raise, say for about the first 30 ft., until this is filled up, and, as operations progress upward, with the footwall raise by successive branch raises as shown. The trenches are carried about 6 ft. wide within the timbers, the posts of a set being about 8 ft. high. The chute raises at the intermediate points between the trenches are used only for drawing off the muck produced in cutting out the sill floor.

After a stope has thus been started, operations proceed upward and lengthwise along the vein, the various steps described from the beginning all being conducted progressively. That is to say, stoping begins at the first point of attack as soon as possible, with the preparation work proceeding in all of the various stages described as one goes to the far end of the block that is being worked. Silling out, for example, must always be ahead of the footwall drift, because otherwise the position of the footwall will not be known. Stoping is usually so far ahead of the drift that the latter can be located just where wanted.

In the course of stoping after a section between trenches has been filled, in resuming drilling a cut is taken above and along the trench and then at right angles to this upward along the wall,

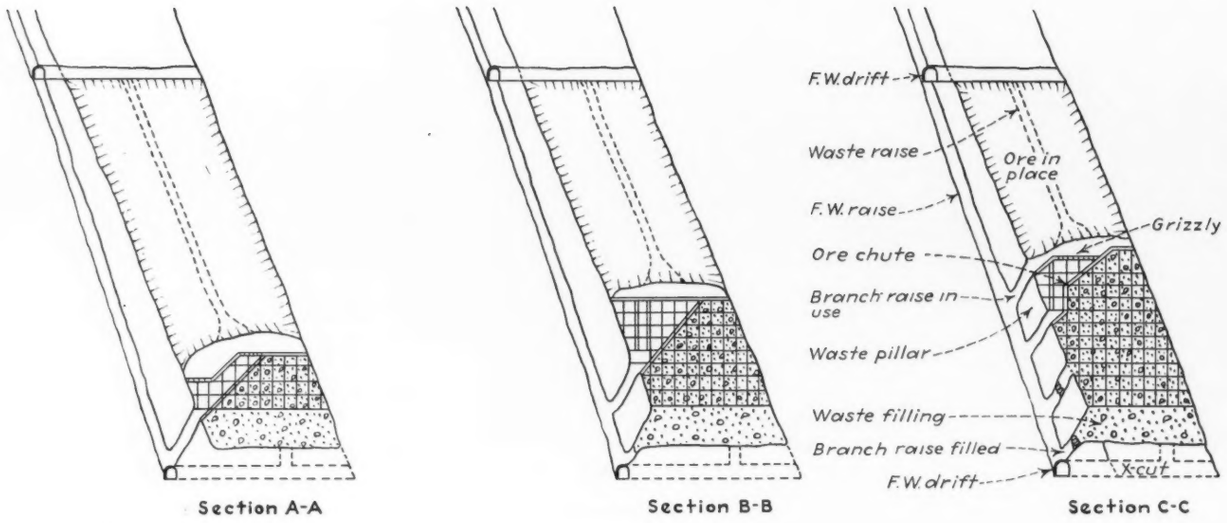
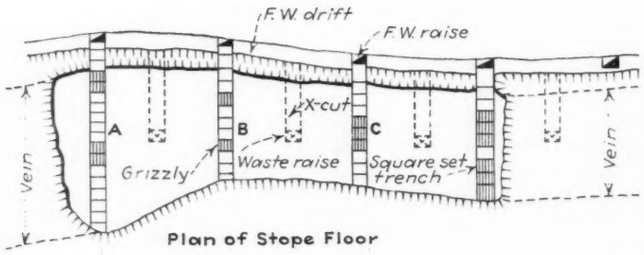
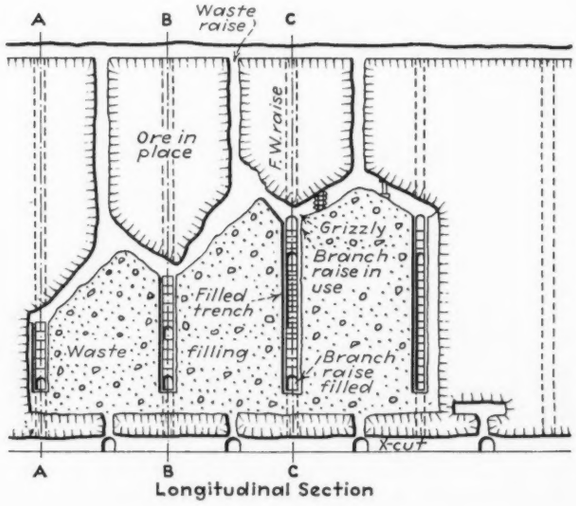


Fig. 1

INCLINED CUT-AND-FILL STOPING

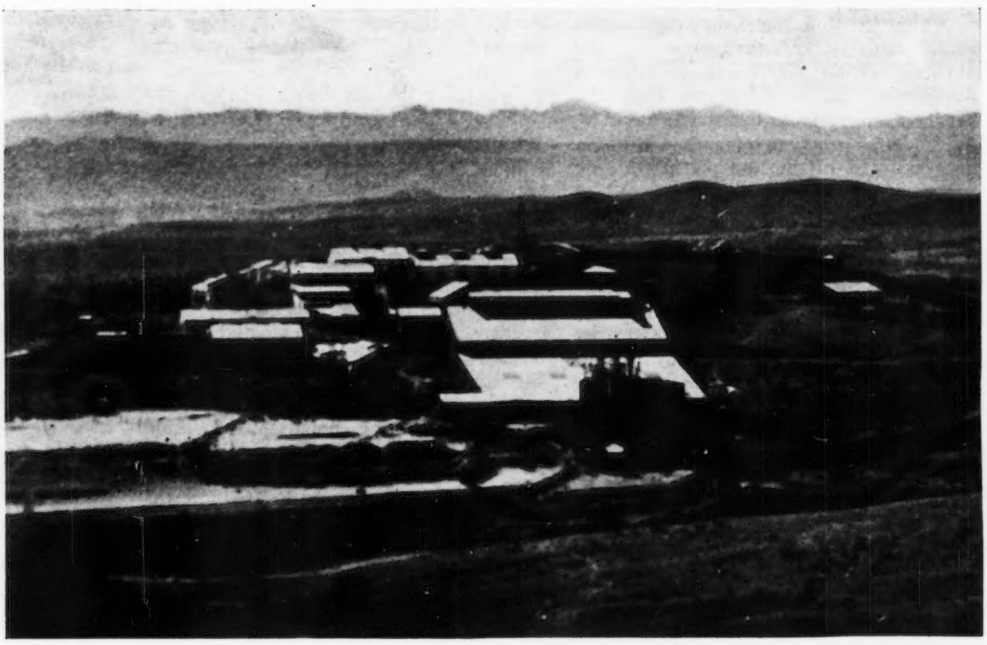
as practiced in the Prieta-Aguilereña workings of the Parral unit is illustrated here in the successive steps of its ideal form. This method is used where shrinkage would cause dilution of the ore





THE PALMILLA MINE AND MILL

of the Parral Consolidated unit, from a distant point. Here one Pedro Alvarado made a fortune, which was dissipated through prodigal spending. The property is at present inactive save for occasional shipments to Parral, some 5 or 6 miles away

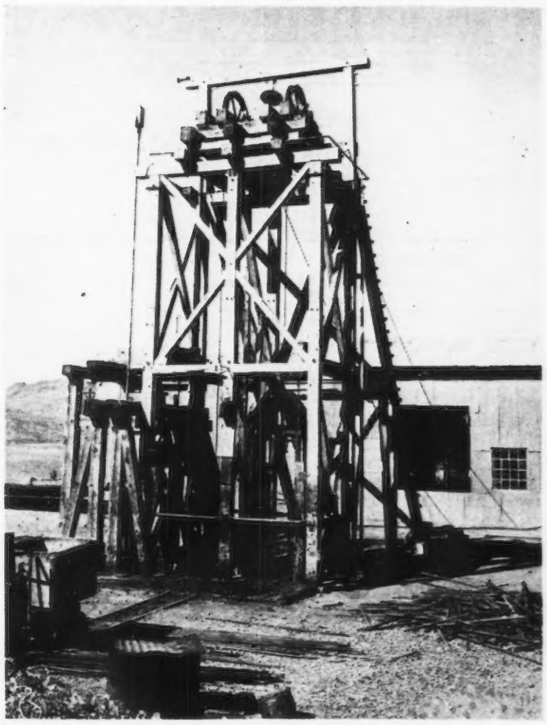


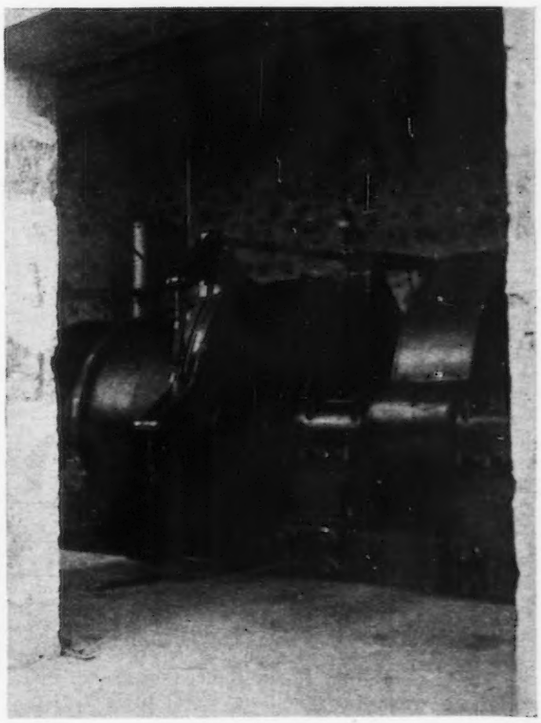
THE VETA GRANDE

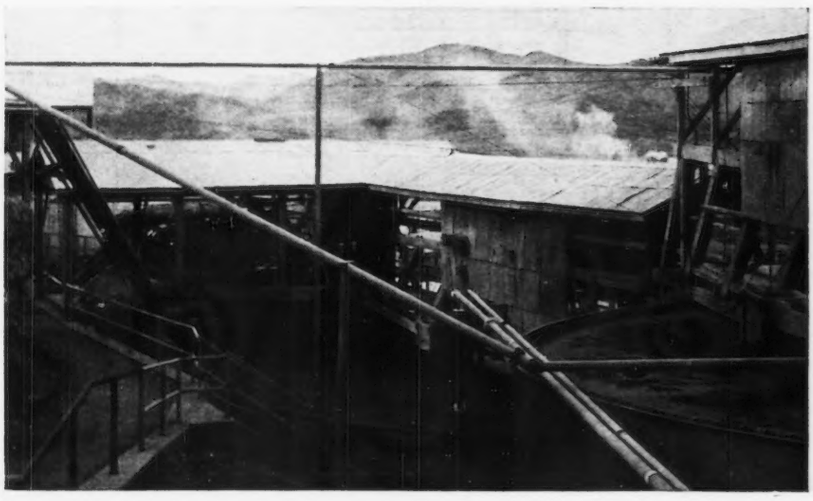
in the Parral district. A property of Cia. Minera Asarco that is located on the Veta Colorada. It was active only a few years ago and now awaits higher metal prices. Close by are the two small and immediately adjacent communities of Minas Nuevas and Villa Escobedo

HOIST ROOM

(below) at the Aguilereña shaft of the Parral unit, seen through the doorway







SAN JUANICO HEADFRAME

(Above at left) This property was first denounced in 1645 or thereabouts. Its workings bottom at 200-ft. depth. Ore of good grade is still reported to be found in spots

AT THE SULPHIDE FLOTATION PLANT

of the Parral unit. At the right is one of the secondary thickeners. In the center, lower down, is the primary thickener. Beyond and above the latter is the de-sanding drag. See the flowsheet, Fig. 2

thus providing a free face, after which the rest of the cut is completed in successive slabbing operations.

Underground haulage is electrified. Six large storage-battery locomotives and one small unit are in service, the large ones being divided equally on the 800, 1,000, and 1,200 levels, on either ore or waste, or both, as the case may be. The longest haul is that on the 800 level between the Aguilereña shaft and the Iguana workings. Rocker-dump cars of 1.6 tons' capacity are used, the maximum number pulled being fourteen.

Considerable water has to be pumped, the amount varying from 3,000 to 8,000 g.p.m. On the 1,400 or lowest level there are at present two one-stage centrifugal pumps, which pump to the 1,200 level. Eventually there will be seven two-stage units which will pump to the 1,000 level, where the permanent station is. On the 1,200 level, four one-stage pumps are lifting 3,000 g.p.m. to the 1,000 level. And from the 1,000 level the water is raised to a drainage adit on the 125 level by four-stage centrifugal pumps.

Practice at both the so-called sulphide mill—a flotation plant—and the flotation-cyanide plant is set forth in the accompanying flowsheets. A few explanatory notes may serve to clarify them.

In the crushing plant of the sulphide mill the Leahy screen is used to keep wet fines from the crusher. It is set so steep that nothing but these are taken. A separate crushing unit is provided in the plant to handle siliceous ores from a number of mines, including the Palmilla and the Veta Grande. These ores are received in 35-ton cars via the Mexican Northern Company's Parral & Durango Railway. Whereas the main feed is weighed on a Weightometer before going to the bin, railroad weights are taken for the Palmilla and Veta Grande ore.

In the flotation reagent building, all reagents are mixed in concrete *pilas,* or tanks, about 8x5 ft. in dimensions and 6 ft. deep, each holding 7,000 to 8,000 liters. There are two *pilas* for each reagent, mixing going on in one while the other is delivering to the plant. The reagents are made as dilute as possible. Where corrosive they are sent to the mill through rubber hose; otherwise through pipe. In the mill, Geary reagent feeders are used.

Reagents used in the lead circuit are sodium ethyl xanthate, Aerofloat 25, Minerec A, and cresylic acid. As a depressant for zinc in this circuit, zinc sulphate is used and barren solution which supplies calcium cyanide. In the zinc circuit the reagents are: copper sulphate, activator: sodium ethyl xanthate, Aerofloat 31, pine oil, barren solution as a depressant for pyrites, and lime.

Grinding in the Hardinge mills in the sulphide plant is done to a fineness of 60 per cent minus 200 mesh. Pulp

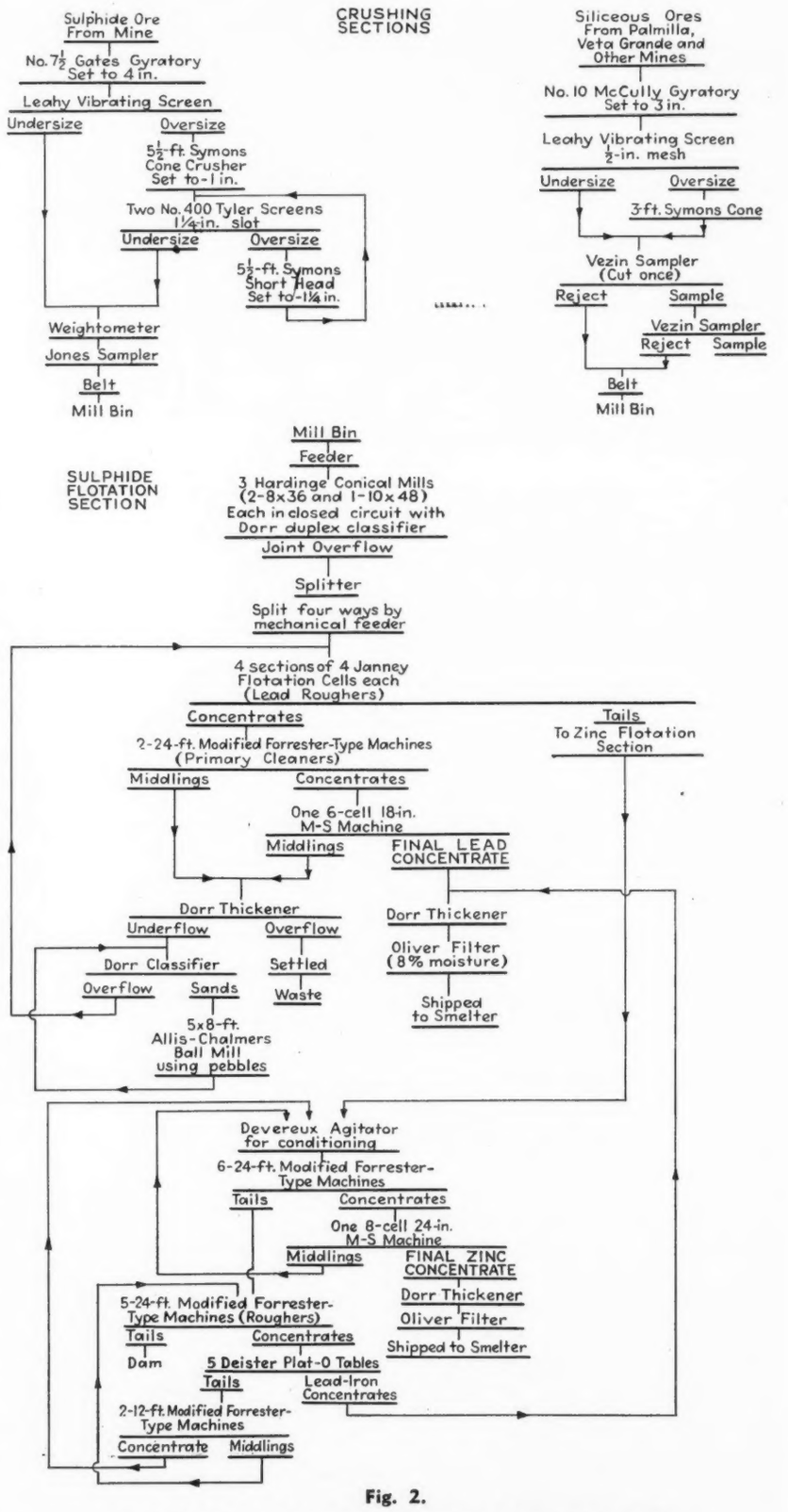


Fig. 2.

FLOWSHEET OF THE PARRAL UNIT'S SULPHIDE MILL

A separate crushing section is provided in the plant to handle siliceous ores from a number of mines, including the Palmilla

density is 79 per cent solids by weight. The circulating load is 400 per cent. Classifier overflow is 37 per cent solids by weight.

Air for the modified Forrester-type cells and the Minerals Separation machines in the sulphide section is supplied from two 11,000-cu.ft. DeLaval blowers.

Concentrate shipped per day from the sulphide section from 1,050 tons of feed is 350 tons, of which 150 tons is lead concentrate and 200 tons is zinc.

In the flotation-cyanide plant, the dilution in the grinding mills is 70 per cent solids by water and that of the classifier overflow 48 per cent.

The coarse sand from the belt drag that follows the agitators, when not going to the filters, is washed in a cone and used with cocoa matting for making filter bottoms in the clarifier tanks to cut down the amount of river sand required.

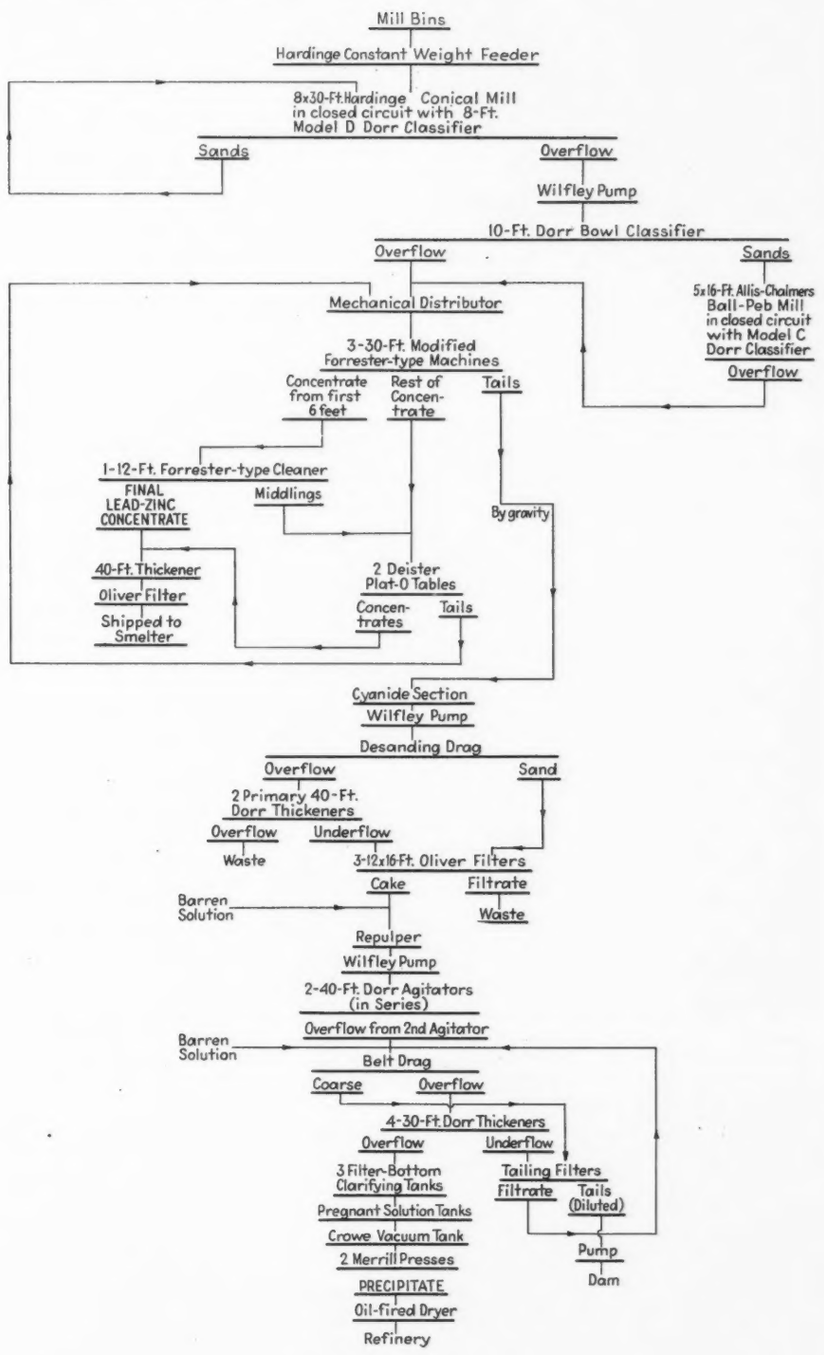


Fig. 3.

FLOWSHEET OF THE FLOTATION-CYANIDATION PLANT

This mill of the Parral unit has a capacity of 350 tons per day. A few additional notes are given in the accompanying text

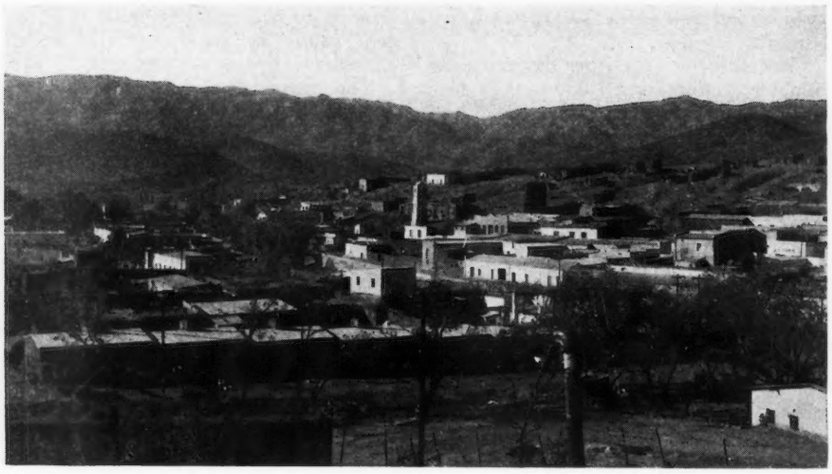
Some five or six miles by road from Parral is the Palmilla mine of the Parral Consolidated unit, previously referred to. Here Pedro Alvarado, about whose prodigality many anecdotes are told, made a fortune in the first years of the century. Subsequently the property, passing into other hands, became part of the holdings of the Alvarado Mining & Milling Company and eventually was acquired by the present owners, for whom the Asarco company manages it. At present it is inactive save for a small tonnage shipped at intervals to Parral. Both the vein that Don Pedro worked and another that perhaps he did not know about occur in a monzonite plug in the andesite, the deposits herein differing from the others in the region. Here, also, are the remains of the old 500-ton mill of the Alvarado company.

Near by is the San Juanico mine, a small property, with five veins dipping away from each other like the fingers of a hand spread downward. Ore of good grade is found in spots. The workings bottom at 200 ft. The geology here also is out of the ordinary for the district, the veins occurring in a tongue of shale surrounded by the andesite. The San Juanico was first denounced in 1645. History has it that one DeCoy worked it with slaves and paid a royalty to the Crown of Castile.

These and other properties of the unit, such as the Cabadeña and the Las Cruces, are producing a total of about 1,600 tons of ore per month, mostly of siliceous character.

Still a few miles further from Parral, and close to the small communities of Minas Nuevas and Villa Escobedo, is the Veta Grande property, situated on the far end of the conspicuous and in the past highly productive Veta Colorada, or Colorada vein. Here there is a mill, which is not running, and shops and a headframe, with residences near by. The property is at the present inactive.

(Any description of the Parral district should comprise three major divisions: Parral itself and its environs, which has just been dealt with; the famous camp of Santa Barbara, which is covered in the following pages; and San Francisco del Oro, where the noted property of the San Francisco Mines of Mexico is situated. The writer was forced to omit the last named camp from his itinerary, however, because of labor troubles then being suffered there and because, in consequence, all operations were suspended.)



SANTA BARBARA—Part of the town, one of Mexico's old communities. It has a population of ten to fifteen thousand—nobody knows just what. The mills of the Asarco company are some distance to the right

Santa Barbara Camp Continues Active

Two mills of Asarco company running on ore from several properties . . . San Diego flowsheet changed

SANTA BARBARA, the town, stands on the bank of the Santa Barbara River, a stream ordinarily of no large flow or width that winds through an area long known for mining and just within the foothills of the Santa Barbara range at 6,250 ft. Centuries have passed since the community, one of Mexico's oldest, and at one time the country's capital, was founded by the Spaniards, so there has been time enough for the name to attach itself in these ways to the neighborhood. The population is possibly ten to fifteen thousand. Here is the Santa Barbara unit of the Asarco Mining Company, comprising a large number of mines and prospects in an area approximately 8 km. north and south and half as wide. Close to the edge of the town are the company's local offices, including that of C. F. Jordan, general superintendent. Near by also is one of the two mills of the unit—the sulphide flotation plant—the other being the San Diego flotation-cyanide mill, a mile or so away.

The first of these two plants is handling 18,000 tons of sulphide ore per month, derived from several sources, and, in addition, 22,000 tons of old tailings from a gravity plant that existed before flotation was introduced. At the second plant—the San Diego—11,000 to 12,000 tons of oxidized ores is being handled monthly by flotation and cyanidation. Of this, 4,500 tons is company ore, 1,500 tons is custom, and the remainder comes from leases. Including the mill forces and those elsewhere on the surface and in the mines, the company is working about 1,200 men.

Ore deposits of this district occur in shales, which are practically horizontal save where folded. Veins are of two general kinds: highly siliceous gold-silver ore, low in sulphides, and veins much higher in sulphide content. In general, the veins strike north and south and are either vertical or dip west, sometimes steeply. The flattest are 45 deg. Average vein width is 3 to 4 meters. Certain dikes are found, post-mineral in age, striking either with the veins or east and west. On top of all is a basalt flow, left at the high points only.

Preeminent among the local mines is the Tecolotes, by reason of its ancient history—of production and otherwise. Today it is yielding 8,500 tons a month, a third of its output in 1929, and is working about 140 men, on two shifts. Its shaft, the collar of which, and the adjacent buildings, are found in a secluded spot in rugged surroundings, much higher than the mills, is down 650 ft.—to the 12th or 1,200 level, allowing for workings above the collar. The veins include the Coyote Seca, from which branch the San Albino, Tecolotes, and Veta Rica. The ore is sulphide, save in the San Albino, which is siliceous in character.

Stoping is done by shrinkage in 200-ft. lifts. The usual method has been interestingly modified in the provision of a grizzly level with a blasting chamber. Chutes of novel design are used, promoting speed in tramming. Tecolotes is the only mine in the unit using electric motor haulage, all others depending on hand tramming. Trolley locomotives of 3½- and 6-ton size are in service, using 250-volt, converted direct cur-

SAN DIEGO FLOTATION-CYANIDE PLANT of the Santa Barbara unit. It is handling 11,000 to 12,000 tons of oxidized ores monthly. Of this, 4,500 tons is company ore, 1,500 tons is custom, and the rest comes from leases. The flowsheet having recently been changed, the new one is presented on page 136.

rent. Two-ton rocker-dump cars, built by Koppel, are used on the 1,200 level and 4½-ton gable-bottom cars on the 1,000 level. Average tramming distance is 1 mile per round trip on a ton-mile basis for both the Tecolotes and adjacent Hidalgo mine. The latter is a continuation of the Tecolotes, and haulage is unified for the two.

In hoisting, a 96-cu.ft. skip is used for ore and a two-deck cage for men. The skip is handled by a second-motion double-drum hoist driven by a 200-hp. 440-volt induction motor and balanced by a counterweight. The cage is operated by a single-drum hoist and a 75-hp. induction motor. The headframe is of timber, approximately 90 ft. high. In it are two gyratory crushers to reduce the size of ore before it goes to the rope tramway which takes it down to the mill.

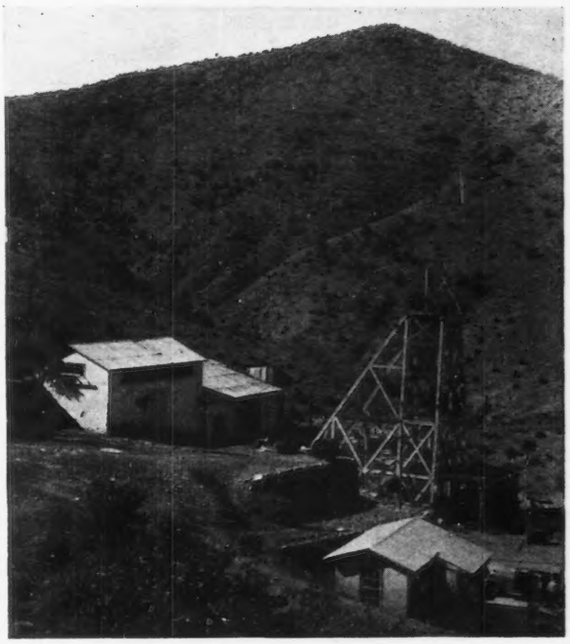
Automatic centrifugal pumping is employed.

On the same vein system are the previously mentioned Hidalgo mine and the Los Angeles, which are connected with each other. The latter more or less marks the western boundary of the Asarco holdings. Each has its shaft, used, however, only for handling men and supplies. They are joined with the Tecolotes on the 1,000 level. The Hidalgo shaft is completed to the elevation of the 1,200 level in the Tecolotes. The veins here are the Hidalgo, split from the Coyote vein, and the Santiago Cobriza vein, a continuation of the Hidalgo system. Los Angeles shaft is down to the 900 level and is 600 ft. deep. The mine has two important veins, the Los Angeles and the Favorita.

In addition to these properties in this section the company also has the recently acquired San Rafael's Cobriza group of claims and the Perros Bravos group, long held by Asarco and surrounded by holdings of the San Francisco Mines of Mexico.

Another group of properties on the same side of the river comprises the so-called Alfareña-Segovia La Paz-Palo Blanco vein system, carrying siliceous gold-silver ores. This is about two miles long. One of the properties, the Alejandria, has the deepest shaft in the district, down 1,300 ft. The ore, both sulphide and oxide, is being developed.

The La Paz-Palo Blanco has been shut down since 1933, but is to be opened up this year. In the old days, its maximum production was about 8,000 tons per month of oxide ore. This



TECOLOTES MINE AND SHAFT

(above) of the Asarco company. An ancient producer, it is yielding 8,500 tons of siliceous gold-silver ore per month, a third of its output in 1929. The shaft is down 650 ft.

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ALEJANDRIA SHAFT

(at left) of the Santa Barbara unit, is the deepest in the district. It is now down 1,300 ft. The mine is under development, being opened on the 5, 7, 9, 11 and 13 levels only. The ore is siliceous and carries gold and silver

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SULPHIDE CONCENTRATOR

(below) of Asarco company at Santa Barbara. It is handling 18,000 tons of ore and 22,000 tons of tailings per month. In the hills that form the background is the company's famous Tecolotes mine and other holdings. Between the camera and the plant lies the Santa Barbara River

ore is exhausted. When the property is reopened it will be on sulphides.

The mines just described are on the northwest side of the Santa Barbara River. In the territory on the other side are several properties, of which the Mina de Agua, at the southwest corner of the company's holdings, is of greatest present importance. This is held in fee by the Montezuma Lead Company and operated by Asarco. It was under water from 1904 to 1933. It is producing 335 tons daily, or 8,375 tons per month, which is to be increased to 12,000 or more. The ore is coming from highly siliceous veins in shale, the values being chiefly gold and silver. The occurrence is on the same vein system as the La Paz-Palo Blanco, across the river. One hundred and forty men are working on two shifts.

As necessary with a property that has been under water so long, care has been taken in reopening. One shaft is open 650 ft. to the 7th level. Cage hoisting is now used, but skips may be adopted and a new headframe built. Where formerly six levels were used, there are now but three (3rd, 5th, and 7th), the level interval having been changed to 200 ft. Shrinkage stoping is used.

Ore is taken to the mill, 0.8 mile away, by 2½-ton White trucks. Trucking is extensively used in this district by the company. The trucks dump into railroad cars at the mill, which in turn are run up on the bins and dumped.

All outcrops are being worked by *buscones*, who furnish everything, working by hand, and sell the company whatever ore they mine. This helps prospect the holdings and furnishes employment.

At the southeast corner of the company's holdings, a property, the Coyote, is being opened on a sulphide vein. Production is 2,500 to 3,500 tons per month. The ore is low in grade, necessitating large-scale operation. A 50-meter shaft, equipped with sinking bucket, is now in service. Transport here also is by White truck, the one-way distance being 1½ miles.

For exploratory purposes a tunnel has been started 80 meters below the present collar, and at the time of my visit was in 350 meters from the portal. It is 9x11 ft. in the solid, in cross-section. An advance of 90 to 93 meters per 25-day month, or a little better than 3.6 meters per day, is being made. Ten men and a boss are employed on each shift, the drillers also mucking.

The operating cycle and procedure are of interest. For drilling, two Gard-

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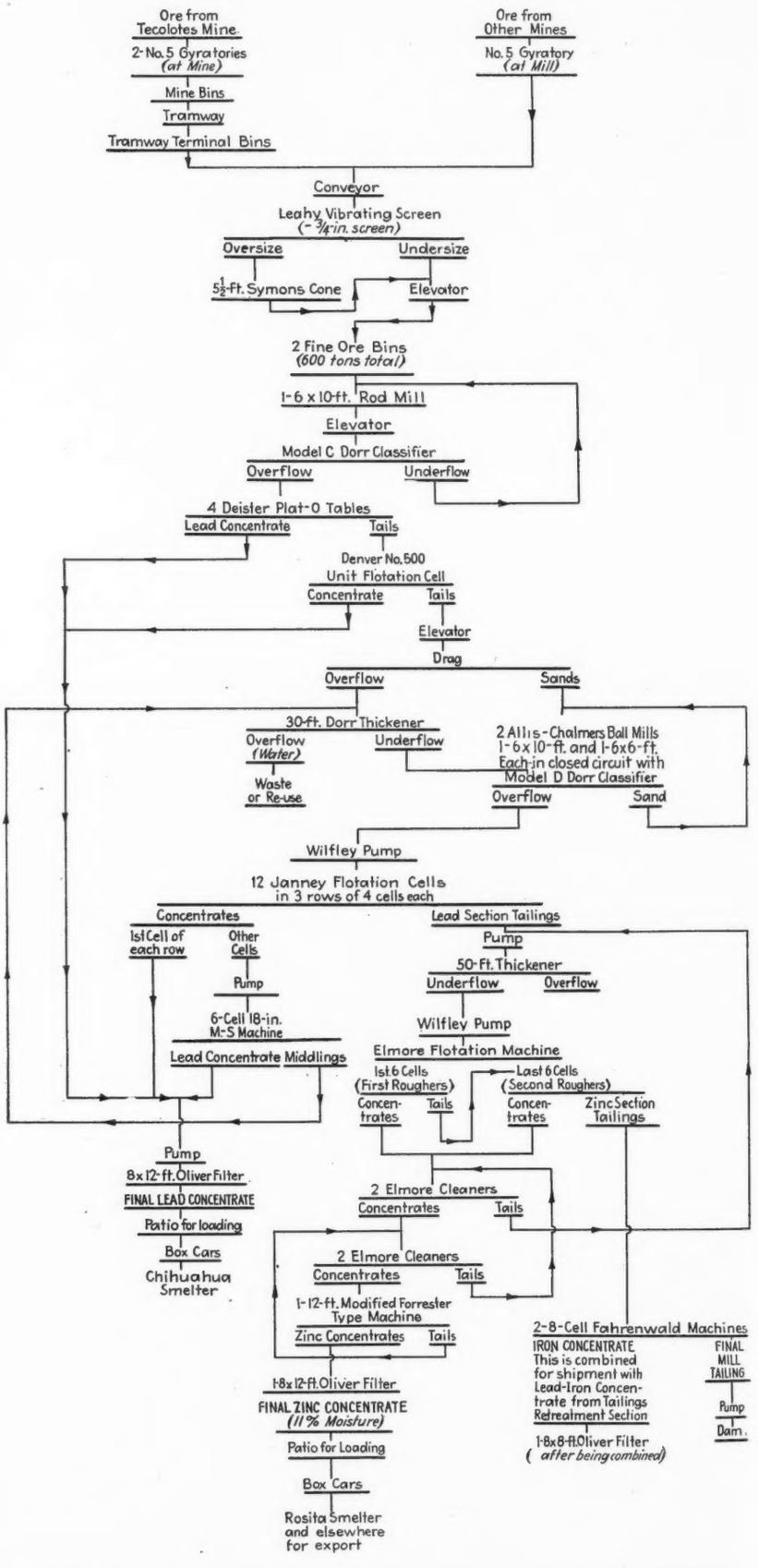
SANTA BARBARA SULPHIDE MILL FLOWSHEET

The ores thus treated are those that cannot be cyanided at San Diego. The tonnage comes from several sources, including the Tecolotes, Mina de Agua, and Alfareña mines. Besides the precious metals the ore contains lead and zinc and 0.8 to 0.9 per cent of copper



ner-Denver D89 drills are employed, both columns and a bar being used for mounting, as will be explained. The cycle prescribes blasting at 9:15 o'clock on each of two shifts, which begin at 7 o'clock. After blasting, on each shift, one machine man and helper set up a cross bar on the muck and drill the top half of the round. The other machine man and his helper, with the aid of peons, muck out the round, using an Eimco-Finlay loader.

By the end of the shift, the face is clean and the top half has been drilled. The next shift coming on at 7 o'clock—night or morning, whichever it may be—drills the bottom half of the round, with the machines mounted on vertical columns, and shoots at 9:15. There is a lapse of four hours between shifts, during which period a trackman and two helpers do all trackwork, lubrication, and miscellaneous tasks. They also set up the drill column so that everything is ready for the following shift.

Mucking is done with 25-cu.ft. rocker-dump cars, 50 to 60 cars of rock being broken per shift. The cars are hauled to the portal in trains of not more than five by a Mancha Little Trammer. At the portal, a trolley locomotive picks them up and hauls them for dumping to a point where a fill is being made for an electric haulage line to the mill. The haul (at the time of my visit) was 350 meters within the tunnel, plus 850 meters outside, a total of 1,200 meters one way.

The drill round has 24 holes and is 2 meters (6½ ft.) deep and pulls 1.85 meters per round. It consists of a V side cut followed by slabbing. Powder used is 1⅛-in. 60 per cent Extra Gelatin, supplied by Cia. Mexicana de Explosivos. Shooting is done with cap and fuse, save when water is encountered. Gases are exhausted from the face through a 10-in. galvanized pipe by a Coppus Ventair blower.

In the manner described, 50 to 60 25-cu.ft. cars of muck are broken per shift. Advance per 25-day month is 90 to 93 meters, or a little better than 3.6 meters (11.7 ft.) per day.

Both here and in the other properties of the unit, drilling practice has more or less settled down to using certain drills. These are the Gardner-Denver D89 3½-in. drifter, the Ingersoll-Rand S49 Jackhamer, and the I-R 51 self-rotating stopers. Drilling is done on day shift only. The drill shop for all mines is at the San Diego plant.

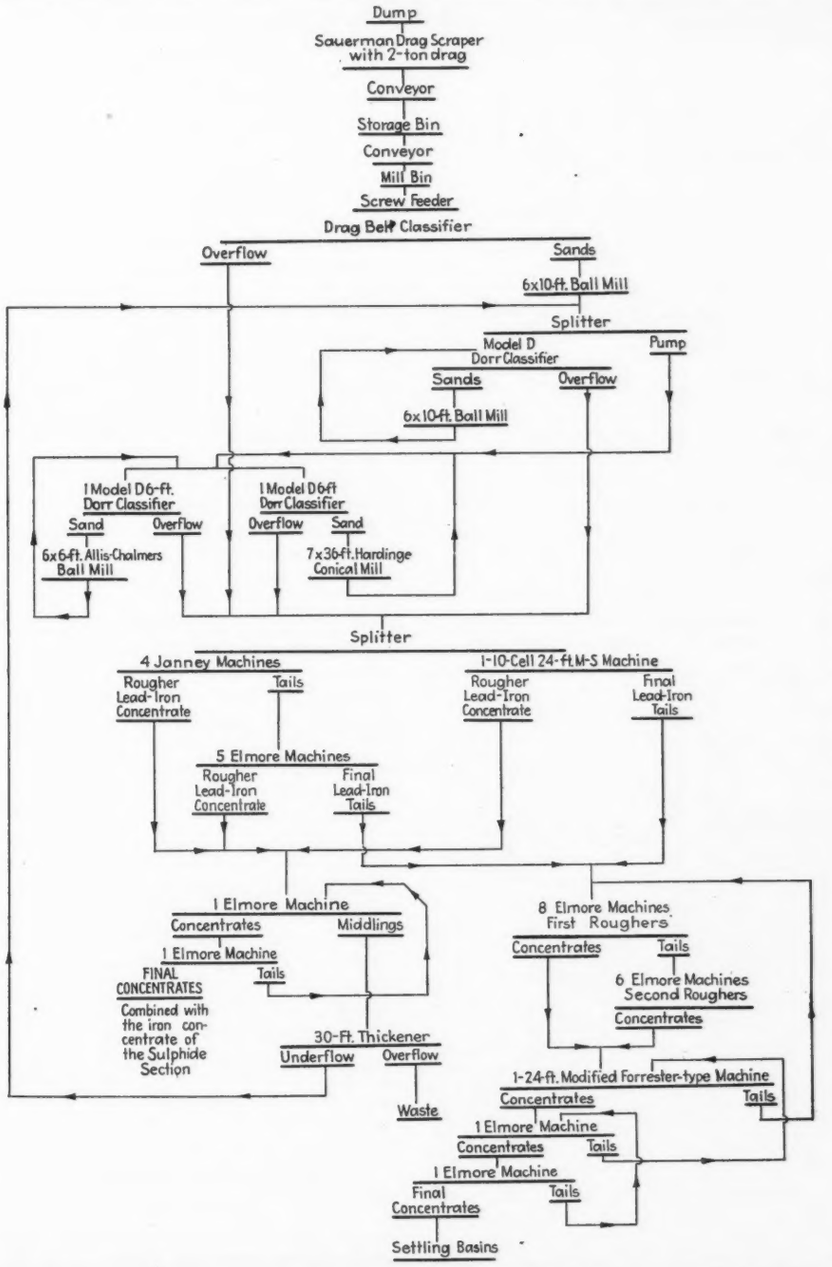
In all mines of the Santa Barbara unit, the underground shifts worked per 24 hours total 470. Counting all other operations also the total number of shifts is 1,170 per 24-hour day.

Accompanying flowsheets tell the story of ore treatment at Santa Barbara. On p. 134 is the sulphide-mill flowsheet by which 18,000 tons of sulphide ore is being concentrated monthly. Treatment of tailings, amounting to 22,000 tons per month, is carried out according to the flowsheet on this page. At the San Diego flotation-cyanide plant, where, as already said, 11,000 to 12,000 tons of oxide is being handled every month, the flowsheet has recently been changed. Under the former procedure, flotation was carried out in cyanide solution. Under the new flowsheet, presented on p. 136, it is done in water.

While the flowsheets tell much, some additional facts will round out the story:

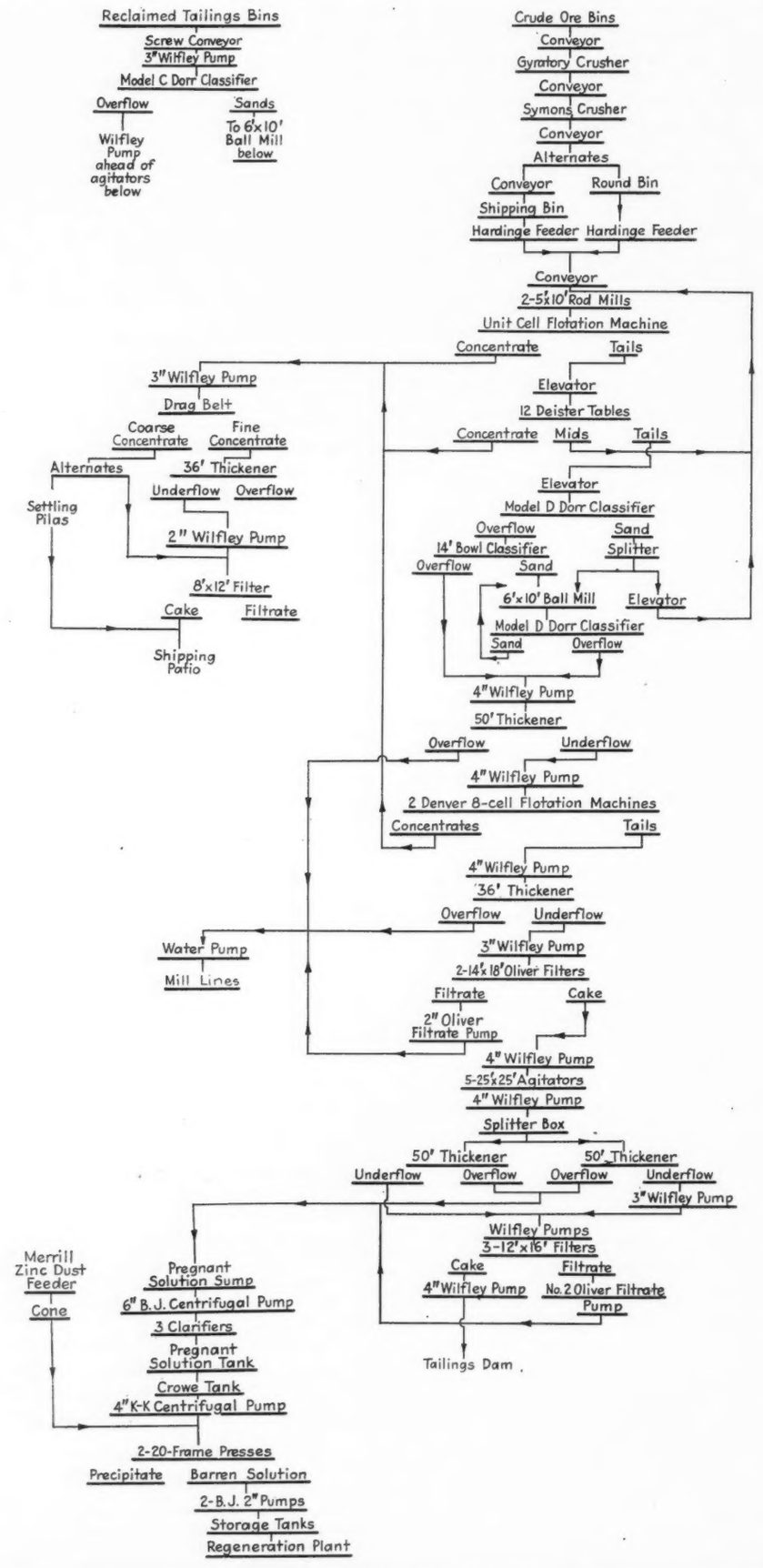
Ores handled in the sulphide plant are those that cannot be treated by cyanide at San Diego, such as sulphides or other ores containing too many sulphide minerals. The tonnage received comes from five or six sources, principally the Tecolotes, Mina de Agua and the Alfareña. An approximate average analysis of the mill heads is: 5 to 6 grams gold, 160 grams silver, 4½ to 5 per cent lead, 5 to 6 per cent zinc, 0.8 to 0.9 per cent copper and 4½ per cent iron, as pyrite.

The four Deister Plat-O tables in the flowsheet on p. 134 serve to equalize the feed to flotation and also to recover small amounts of lead sulphate and car-



TAILINGS

to an amount of 22,000 tons per month are treated according to this flowsheet at the sulphide mill of the Santa Barbara unit. They come from a dump built by a gravity plant that was operated prior to 1925



bonate and free gold. The concentrate made by them runs about 52 per cent lead, 5 per cent zinc, 1 per cent copper, and 9.5 per cent iron, and on the current rate of feed amounts to about 10 tons a day. The function of the Denver unit cell is to float the coarse gold and take it out of the circuit.

Approximate quantities of flotation reagents used in the sulphide plant are as follows, in pounds per ton: *Lead Circuit:* Sodium bicarbonate, 1.0; zinc sulphate, 0.4; Minerec, 0.01; sodium cyanide, 0.15; Barrett 634, 0.05; pine oil No. 5, 0.02; mixture of amyl and ethyl xanthates in the proportion of two amyl to one ethyl (to give a better frother than either one singly), 0.02; cresylic acid, 0.25; Aerofloat 31, 0.04 lb. *Zinc Circuit:* Copper sulphate, 0.6; Barrett 634, 0.05; pine oil No. 5, 0.02; and xanthate mixture 0.04. *Pyrite Flotation:* Copper sulphate, 0.04; xanthate mixture, 0.37; pine oil No. 5, 0.01, and sodium hydroxide, 0.10.

Tailings re-treated at Santa Barbara are from a dump built by the operation of a gravity plant between 1909, approximately, and 1925. Their approximate analysis is: 2 grams of gold, 75 grams silver, 1.4 per cent lead, 0.43 per cent copper, 4 per cent zinc, and 4 per cent total iron. About 22,000 tons is being treated monthly.

In the efforts made to treat these tailings successfully it has been found imperative that the first time they are ground they must be slime-free and ground in open circuit. In the flowsheet on p. 134 the purpose of the drag belt classifier is to wash out soluble salts.

Reagents and the quantities used in tailing re-treatment are as follows: *Lead-Iron Circuit:* Pure trona (37.1 per cent $NaHCO_3$ and 47.0 per cent Na_2CO_3), 1.7 lb. per ton; zinc sulphate, 0.7; thiocarbanilid, 0.2; sodium sulphide, 0.14; sodium cyanide, 0.10; xanthate mixture (previously described), 0.04; pine oil No. 5, 0.03; cresylic acid, 0.14; reagent No. 208, 0.02. *Zinc Circuit:* Copper sulphate, about 0.5 lb. per ton; Barrett No. 634, about 0.04; pine oil No. 5, 0.02; and the xanthate mixture, 0.03.

At the San Diego flotation-cyanide plant, when the new flowsheet is installed, the management hopes to grind to 67 per cent minus 200 mesh on 400 tons a day. The solution will be put into the agitators. Agitation time will be close to 50 hours. Reagents, approximately, will be sodium sulphide, 3 lb. per ton; sodium silicate, 0.5; and 2 lb. of heavy oil, a mixture of about 89 per cent of chapapote, pine oil, kerosene, and C. C. creosote.

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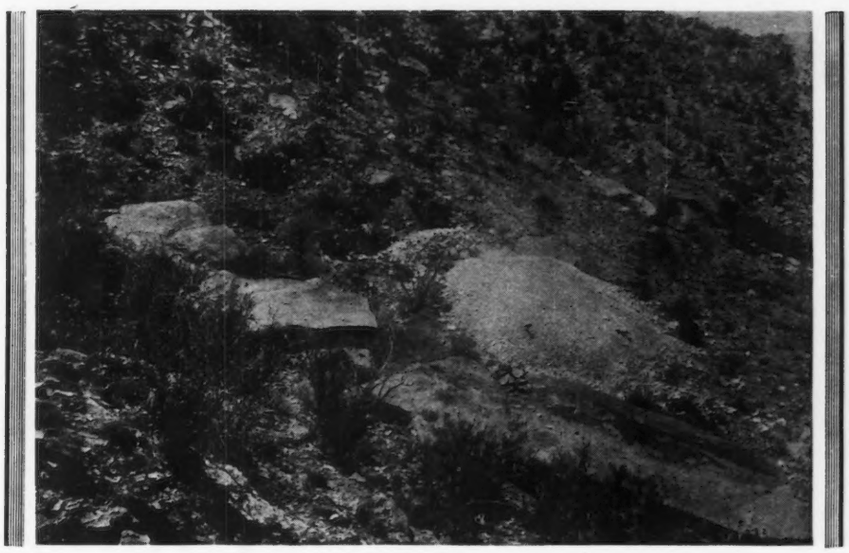
FLOTATION-CYANIDATION FLOWSHEET

only recently worked out for the San Diego mill. Under the former flowsheet, flotation was carried out in cyanide solution. As now changed, it is done in water



An outcrop of Doña Anna magnesite

Magnesite in Doña Anna County, New Mexico

H. H. Taft

El Paso, Texas

A BROKEN RANGE of mountains east of the Rio Grande extends northward through New Mexico and into Colorado. They consist chiefly of limestone and have been tilted in various directions by igneous intrusions. The Franklin Mountains, a few miles north of El Paso, Tex., may be considered the first southerly unit of this mountain range. To the north is a pass which separates Franklin Mountains from the Organ Mountains, which are east of Las Cruces, N. M., and about 45 miles north of El Paso. North of the Organ Mountains are the San Andres. A considerable amount of geological data are available on the San Andres and Franklin Mountains, but the Organ Mountains have received less intensive study.

The lowest and oldest sedimentary formation is Cambrian quartzite and sandstone, which is overlain by approximately a thousand feet of El Paso limestone. Above this is the relatively thin Montoya limestone and above the Montoya deposit is Fusselman limestone. All these limestones are dolomitic. The intrusive in the Organ Mountains is quartz monzonite, with some syenite. The former has pushed through the limestone and formed the pinnacles, which resemble pipes of an organ when seen from a distance. These peaks reach an altitude of 9,000 ft.; and the valleys on the east and west are between 4,000 and 5,000 ft. above sea level. The southeasterly spur forms with the south end of the mountain a bay in which is situated the Doña Anna target range, consisting of two townships belonging to the United States War Department and used by Fort Bliss troops as a target range. The north boundary is the township line between 23 and 24 South Range 4 East, which passes through the magnesite regions which lie on both sides of the ridge. A third and probably smaller occurrence is north of the Organ pass on the southwest side of San Andres Mountain.

The magnesite is considered due to metamorphic action in the dolomitic limestone brought about by the intrusive syenite and monzonite. In the Franklin Mountain and perhaps elsewhere this is prevented by the bed of quartzite, which underlays the dolomite and limestone. Where absent, the dolomite is altered to marble, recrystallized, and in considerable areas, to predazzite, a condition described in the United States Geological Survey Bulletin 770 from a locality near Predazzo, in the Tyrol.

In predazzite the lime and the magnesium minerals are separate, and can be seen without the aid of a lens. There is some doubt whether the magnesia mineral is magnesite or brucite; probably both occur. Under the predazzite is a bed of honeycombed limestone, like gold quartz with the pyrite removed by leaching. The spaces are small but can been seen without a glass. The magnesia mineral has been leached out and redeposited beneath in beds from one to five feet thick. It is of fine quality, as the following analyses show:

Ignition loss	51.23	51.31	52.39
Silica	1.74	2.51	0.13
Iron and alumina	.57	.74	.71
Calcium oxide ..	3.28	.96	2.00
Magnesium oxide.	43.18	44.48	44.77

The discovery was made by F. Schneider, who at one time made stucco, tiles, lithophone and similar products. The only work done on this magnesite has been that necessitated by title requirements and assessment work to acquire and to hold title under the lode claim law. The extent of the various deposits is unknown. It is possible that the much more abundant predazzite can be utilized as a source of magnesite.

Recrystallized limestone and dolomite is not uncommon in lead mines, and the occurrence of such rock is a favorable locality in which to search for lead-silver ores. Generally it is in contact with some intrusive rock. Rarely, as in the Lamentos mine, in Chihuahua, is it a bedding plane with no intrusive in sight. The younger more basic rocks alter the limestone but slightly, and it is noticeable that the magnesia minerals are in contact with or near the oldest of the intrusives; also that the lower beds of the limestone series are more likely to be dolomitic.

The locality is favorable for mining operations. Labor is cheap and abundant in and near El Paso, and a gas pipe line passes through the Anthony gap. An oil pipe line reaches El Paso. Most of the deposits are from 15 to 20 miles from trunk lines of the Sante Fe and Southern Pacific railroads going north and northeast from El Paso. The foot of the mountain can be reached with an automobile. The climb to the various openings is a thousand feet vertically in two or three miles.

LA RUE MINE PIT, on Mesabi range, as seen from the washing plant of the adjacent Shada mine. The conveyor "A" takes its load from a movable hopper, which is supplied by a shovel in the pit, and transfers it to the incline conveyor seen in the lower left

• Economical operation the objective of Butler Bros. in equipping La Rue mine thus . . . Ore moved directly to Shada washing plant

Belt Conveyors

Adopted for Open-pit Transport At Mesabi Range Mine

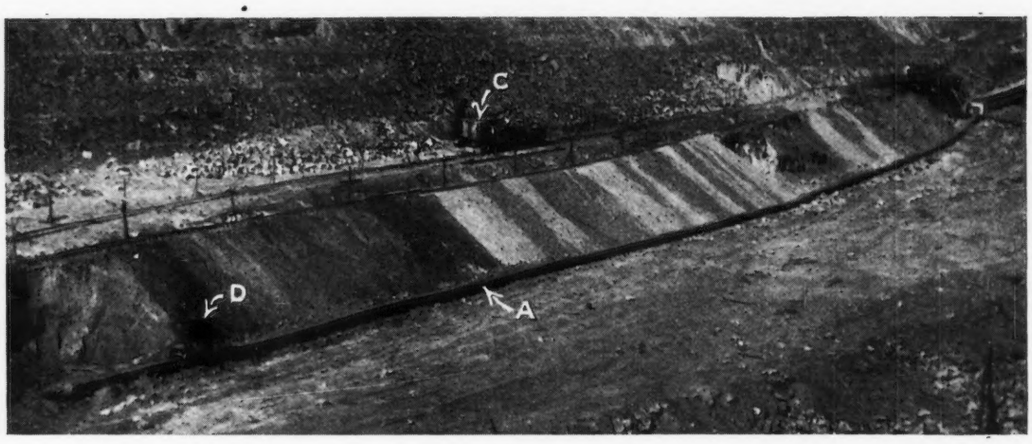
L. C. Moore
Mechanical Engineer
Hibbing, Minn.

UNTIL RECENTLY, steam and electric locomotives have been standard equipment to remove iron ore from open-pit mines. Now a belt-conveyor system is being used at one mine by Butler Bros., one of the most progressive independent operators on the Mesabi range. It is the same company that is working with the University of Minnesota Experiment Station making sinter from hematite concentrates at the small experimental plant near the Harrison mine.

This belt-conveyor system is located at the LaRue mine, near Nashwauk, Minn. The old LaRue mine, operated by the M. A. Hanna Company, was stripped with a 225-B drag-line shovel some years ago, and steam locomotives were used for haulage to the washing plant. A similar system was used by the adjoining Shada mine, which was formerly operated by the Clement K. Quinn Company but released to the fee owners, the Mississippi Land Company, about 1928. The present LaRue mine operation takes in the old LaRue, on the south, and utilizes the Shada mine's washing plant at the north end of the extended pit, and the present ore is secured from underground mining beneath the east bank *B* and small deposits left in the pit by previous operators.

With this combination of conveyor belts and a small electric locomotive that hauls from underground to stockpile, all-year economical operation can be secured in a manner that is highly desirable, especially as to labor, in a district where most operators work on a six months' season. Conveyor belts are also used underground to move ore from the contract places to main haulage pockets. The ore is all of wash quality, and provision is made for a stockpile about 700 ft. long, 40 ft. high, and 300 ft. wide, holding approximately 500,000 tons.

When the ore season starts in the spring, the ¾-cu.yd. gas shovel shown just now at *C* loads in the pit onto conveyor *A* through movable hopper *D*. The ore passes from the horizontal 700-ft. 30-in. conveyor belt *A* to a 300-ft. belt, inclined at 20 deg. In turn, this transfers to a 350-ft. 30-in. belt of the



HORIZONTAL CONVEYOR

in La Rue pit is here seen more clearly; also the movable hopper through which the ore is delivered to it by the shovel, here seen on the bench above at C

LA RUE PIT looking north. This shows more plainly the junction of the horizontal conveyor "A" with the incline conveyor which delivers to the feed bin of the washing plant. The ore now mined comes from underground mining beneath the east bank "B" and from small lots left in the pit by earlier operators

WASHING PLANT at Shada mine. This formerly served the property, which was once operated by Clement K. Quinn Company and subsequently released to the fee owners. It stands at the north end of the extended pit. Tailings ar sent to the pond through the launder "E"

same inclination that carries it to a bin near the washing plant. From this pocket the ore is fed to the mill by a 30-in. belt which passes it over a screen ahead of a small jaw crusher that reduces all chunks larger than ¾ in. The crushed product and the screen undersize are carried by a 30-in. belt to the top of the washing plant, where it is treated with a 25-ft. log washer and a bowl classifier. The concentrates are loaded into railroad cars and the tailings are sent to a pond some distance away through an overhead wooden launder, shown at *E*.

On these belt drives 440-volt motors of various size are used. The smallest, 15 hp., drives the 700-ft. horizontal belt. The incline belts require 40-hp. machines. A substation supplies power.

Detailed costs are hard to secure for publication, inasmuch as the operators feel that they are pioneering on new systems of this sort. However, with the tractor companies participating in some of this dirt and ore moving, the cost of ore transfer by various methods has become fairly well known. The rule-of-thumb assumption, that a ton of ore can be moved 1,000 ft. on a belt conveyor inclined at 20 deg. for one tenth of a cent, seems to be established and used in comparison with other methods of moving dirt. Details, such as location of ore deposits in pit, the various grades to be treated, the structure of the ore deposits and their formation, as well as location of washing plant, must be given careful consideration before the cheapest method of moving material can be decided on. To judge from the smoothness of operation of the installation described, and from the few men needed on upkeep and the slight wear on conveyor belts and machinery, this system seems all that could be desired for one-half unit plants of less than 200 tons per hour, for low cost production of washed ore. R. O. Hocking is manager for Butler Bros. and J. A. Stampe is mine superintendent.

Repairing a Telpher Crane

RAPID WEAR of the ½-in. steel cable on a hook-type telpher crane employed at a large lead smelter in Central Spain to fill the coal bunkers at the steam power plant, necessitating frequent replacement of cables and causing one serious accident at the boiler house because of sudden breakage, was a matter of concern, writes Jose Espinosa, power plant engineer. The hoisting mechanism of the crane as delivered by the factory is shown in Fig. 1. Capacity is 1,000 kg., hoisting speed 3 ft. per second, and maximum lift 60 ft. Under normal working conditions the cable was guaranteed by the manufacturer to last from ten to twelve months. In actual operation, however, the first cable broke after but six weeks' service, and the second cable showed such wear after four weeks that it was considered unsafe and had to be removed. A careful inspection of the hoisting unit disclosed that the fixed and loose pulleys at the side of the cable drum, the use of which was questioned at the time of erection of the crane, caused the cable to operate under undue tension and bent it about 180 deg. during the lift, with consequent early breakage of the strands and ultimate failure of the cable proper. The difficulty was finally overcome by removing the two sets of pulleys and by attaching the cable to the drum as shown in Fig. 2. The third cable has been in operation over nine months without sign of wear.

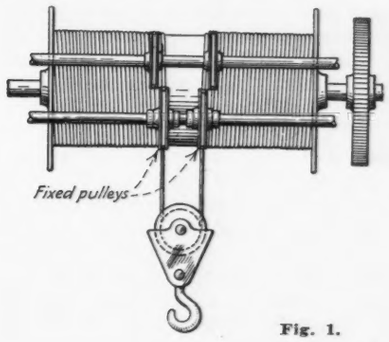


Fig. 1.

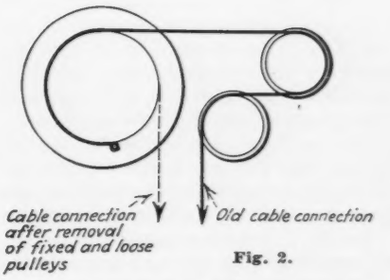
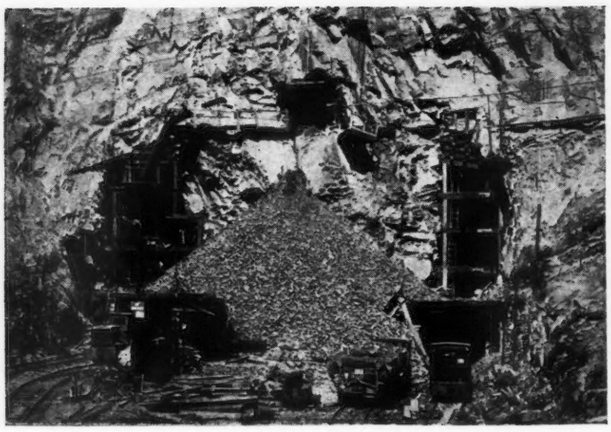


Fig. 2.

Fig. 1—Hoisting mechanism of the telpher crane as delivered by the factory. Fig. 2—Diagram showing how cable was attached to drum and the two sets of pulleys removed



WEST FACE with top drift and side walls removed by stoping

CORE REMOVAL follows the concreting of top and side walls

Mining Technique Used In Driving the Yerba Buena Tunnel

A record size bore for a roadway of the San Francisco-Oakland Bay bridge is advanced through shale and sandstone under protection of 16-in. steel roof beams

George J. Young
Consulting Editor

TUNNELS of large size, whether in respect to length, cross-section or difficulties of driving, are of interest to the mining fraternity, regardless of the use to which they may be put. The Yerba Buena Island tunnel, one of the links in the San Francisco-Oakland Bay bridge, now under construction, is noteworthy for its large cross-section, which reaches a clear width at the spring line of some 65.5 ft. and is close to 50 ft. in maximum height. It is, however, only 540 ft. in length. An upper deck for automobile traffic is provided as well as a lower roadway, for trucks, of maximum width of 34.5 ft. and a minimum height of 16 ft., and a space for interurban tracks, of maximum width of 27 ft. and a minimum height of 20 ft.

The open-cut excavations on the east and west approaches approximate respectively 145,000 and 144,000 cu.yd. Tunnel excavation is estimated at 72,500 cu.yd., or 134.3 cu.yd. per foot of length. The cross-section averages 3,623.4 sq.ft. in area at the rock line. Allowable overbreak was 20 per cent and as measured ranged from 14 to 14.5 per cent. Approximate costs are: Approaches, $200,000; tunnel, $730,000 ($1,352 per foot); portals, $117,000; total $1,047,000. Total concrete in tunnel is estimated to be 15,650 cu.yd. Permanence of construction and large cross-sectional area are the significant factors contributing to the high cost.

Yerba Buena Island divides the Bay bridge into two parts, the western part being of suspension type and the eastern part of truss and cantilever type. The island formation consists principally of sandstone with more or less inbedded dune sands, and the principal ridge penetrated by the tunnel reaches a maximum height above the tunnel section of some 170 ft. The material encountered by the tunnel is a massive to contorted sandstone with some shale layers and seams. Weathering and ground movements have produced a more or less shattered rock mass, the degree of shattering varying in different parts of the tunnel line but in no case involving any great difficulty in excavation or support.

As a preliminary to tunnel excavation, a series of horizontal drill holes, 2 in. in diameter, were drilled by diamond drill in the west portal face to depths of 200 ft., the holes being placed in an area above the position of the arch and in two arcs with staggered arrangement so that a single hole accounts for a horizontal cylinder of rock about 10 ft. in diameter. Some 25 holes were drilled in each face, and these were grouted in 50-ft. sections, the objective being to cement the shattered rock mass above the tunnel section as much as possible. The total footage drilled was 12,500 ft., and 10,439 sacks of cement were used in the grouting. The average pressure used in the final grouting was 275 lb. per square inch. It is of interest to note that, according to H. Carter, engineer in charge of construction, beyond the first 50 ft. but little evidence of grouting was discovered in the excavation of the tunnel.

The method of tunnel construction is relatively simple. In the squared-up faces of the approaches, excavation was started by driving two 14x14-ft. drifts, one on each side of the tunnel section at tunnel subgrade, and a top drift 9x8 ft. in section as indicated in Fig 1. These were extended the length of the tunnel and timbered, the lower drifts being supported by 12x12-in. timbers. Above the side-wall drifts successive lifts or stopes were taken out and timbered until sufficient space had been obtained for the construction of the concrete side walls up to the spring line of the arch. The excavated rock was loaded into cars by means of a Sullivan drag-scraper loader and hauled to the dump by a Plymouth gasoline locomotive. Fig. 1 indicates the condition at this period. Four crosscuts were also driven over the center core and connecting with the top drift, thus affording eight faces for the starting of the excavation of the arch section. The excavation of the footings of the side walls followed next. Concreting and construction of the lower forms for the side walls then took place. The side walls were concreted in successive heights and in stepped lengths of about 50 ft. up to the spring line of the arch. Concrete was pumped through a 7-in. pipe into the forms.

Upon the completion of both side

walls, the eight faces formed by the four crosscuts were started and the portion to be occupied by the arch and the necessary working space beneath was excavated, the broken rock being discharged into the space between the side walls and the central unexcavated core. Surplus rock was loaded into small cars and hand-trammed to either end of the tunnel and dumped. As the arch section was opened up, steel roof beams, each consisting of five segments of 16-in. H-beams, were placed at 3-ft. centers, their foot plates resting upon the spring areas of the arch foundation, Fig. 2. Additional support was obtained by lagging and cribbing resting upon the roof beams.

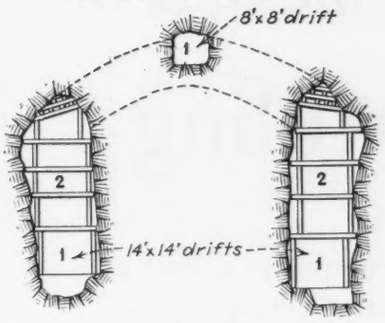
After completing sections of the arch section, two steel forms, one for each end of the tunnel, were erected. These consist of steel plates reaching a length of 82 ft. along the arc of the arch and 20 ft. along its length and stiffened by steel trusses upon the underside. The steel forms are handled upon a low "jumbo" car supported upon tracks laid upon the central core.

Before preparing to concrete a 19½-ft. section of arch, steel reinforcing consisting of 1¼-in. bars was hung on 8-in. centers between the roof beams. The rock at the crown of the arch was cut out along the length of the section and above the roof beams to afford access for pipes. Then the section was cleaned out and the steel form (centering) was moved into place and raised by jacks into its position. Stulls were placed for additional support at quarter points, ends and center being footed against the central core (Fig. 3).

A bulkhead form was constructed at the end of the section. The inner steel surface of the form was oiled with a heavy grade of oil and the gooseneck of the concreting pipe placed in position in the top cut previously mentioned (called a monkey drift). The concrete was then pumped into the form, two compressed-air-driven vibrators being used to obtain maximum density of concrete. The concrete is pumped through a 7-in. pipe by a Rex "Pumpcrete" pump, which is placed near the west portal and supplied by an overhead hopper into which successive batches of mixed concrete are dumped by trucks. The concreting pump has a capacity of 60 cu.yd. per hour against a vertical lift of 120 ft. and a total distance of 1,000 ft.

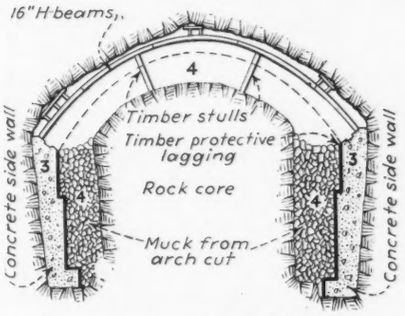
A 19½-ft. section of arch requires about seven hours for pouring (250 cu.yd.) and about five days to attain sufficient strength for the removal of the form. Upon the completion of a pour, the pipe is removed and the top cut at the crown of the arch filled with concrete by means of a small Hackley compressed air chamber. Grouting is at times necessary to fill completely all spaces at the top, as the job involves complete concreting to the rock surface above the arch. The concreting pipe is

Sequence of
CONSTRUCTION OPERATIONS



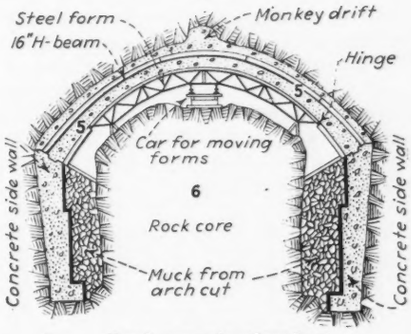
1 . . . Lower side wall and top center drifts driven
2 . . . Side-wall drifts raised by stoping

Fig. 1



3 . . . Concrete side walls placed
4 . . . Arch heading advanced, roof beams placed, muck piled in side-wall drifts

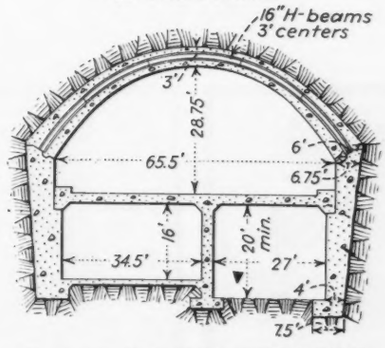
Fig. 2



5 . . . Roof concrete placed
6 . . . Central core removed

Fig. 3

COMPLETED SECTION
OF THE TUNNEL



The upper deck will be used for high-speed traffic, the lower left section for trucks, and the section in the lower right for transit lines

cleared by forcing a "chaser" ahead of a column of water introduced into the pipe. Two pours, or two 19½-ft. sections of arch, per week is the maximum speed attempted. The bottom sketch shows the completed tunnel section.

The tunnel plant presents no special features. It comprises two compressors (550 and 1,250 cu.ft. per minute, electrically driven); a drill sharpener and an oil furnace for heating steel; a Plymouth gasoline locomotive; a Sullivan scraper loader; five trucks; a 1¼-cu.yd. gasoline power shovel; a hoist for handling materials upon an incline extending to a conveniently placed dock; a special truck upon which is mounted a hoist for handling H-beams; a Rex "Pumpcrete" unit for handling concrete; a concrete mixing plant at dock level; and a skip for raising mixed concrete up an incline to a hopper from which trucks receive their loads.

Following the seasoning of the arch concrete, excavation of the rock core was started. After drilling and blasting a round, the rock is barred down and loaded out by the power shovel into trucks, which discharge into a surface bin delivering by belt conveyors to barges. One power shovel is being used for service at both ends. Drifts, side stopes, and the crown drift account for 22,303 cu.yd. of excavation; roof or arch excavation amounts to 10,000 cu.yd., and the core to 38,500 cu.yd. The work of drilling, blasting, and loading out the core material is now in progress, and the final work of completing the arch is now expected to be finished within a short time. The east and west faces of the core excavation are worked alternately. Following upon this final excavation is the construction of the forms for the deck and its support, which is now in progress at the eastern side of the tunnel.

The tunnel is being constructed by T. E. Connolly under a subcontract with the Clinton Construction Company. William Connolly is superintendent for the subcontractor, and T. A. Petersen is superintendent for the Clinton Construction Company. The bridge design and erection is under the San Francisco-Oakland Bay Bridge Division of the State Department of Public Works of California. Harry Carter is resident engineer; C. H. Purcell, chief engineer; C. E. Andrew, bridge engineer; and G. B. Woodruff, engineer of design.

Comparative tunnel sizes are of interest. The Boulder Dam diversion tunnels are 50 ft. inside diameter with walls 3 ft. in thickness. The Holland vehicular tunnel has an external diameter of 30 ft. 4 in. and an inside diameter of 27 ft. 8 in. Rove ship tunnel, port of Marseilles, is 72.26 ft. in width at the spring line, and about 48 ft. in maximum height, and some 4½ miles in length. In point of cross-sectional area the Yerba Buena tunnel exceeds all other tunnels as far as present information indicates.

Some Fundamentals of Rock Milling

Destined upon perfection to supersede present ball-mill grinding to a large extent, the author thinks

A. W. Fahrenwald
Dean, Idaho School of Mines
Moscow, Idaho

EXPERIMENTS are discussed here that deal with a few of the elementary fundamentals of rock milling, at least with a certain phase of the process. They are not extensive, but the few data obtained are interesting and may suggest lines of attack to others. By "rock milling," I should explain at the outset, I mean the grinding of rock or ore with or by rock or ore.

The mill used in this study was 35 in. in diameter by 8 in. in length, having a volume of 4.45 cu.ft. Its critical speed is 44.87 r.p.m. The speed used in the tests was 80 per cent of critical, equal to 36 r.p.m.

Two kinds of rock were used, one a fine-grained basalt obtained from a near-by road-rock quarry, and the other a hard, white quartz. The data obtained on the basalt runs were very similar to those for quartz, and for that reason they are not given in this paper. The basalt abraded more easily than the quartz.

The laboratory work was carried out by F. V. Schneider, senior in the Idaho School of Mines, 1934.

In making up a rock load for the mill, the rock pieces, 2 to 3 in. in size, were selected by hand. In a third run, a one-quarter mesh quartz feed was used.

The void volume of the grinding media was found by filling a container of known volume with media and water and weighing the water. The volume of water thus added was taken to be the volume of the voids in the medium. Basalt had a void volume of 53.7 per cent and quartz 53.25 per cent. This volume, it may be observed, is considerably greater than for spheres.

In all runs the mill was loaded 40 per cent full by volume, or 1.78 cu.ft. Enough water was added to just fill the void space. In the third test, however, the $\frac{1}{4}$-in. feed and water filled the void space. In this test the mixture contained 30 per cent quartz and 70 per cent water by weight. These conditions, although dictated to some degree by testing experience, are more or less arbitrary.

Test No. 1. Made on Quartz Rock—The mill loaded with quartz rock, as previously specified, was rotated at 36 r.p.m. for four ten-minute periods. At the end of each period the abraded sand and water was flushed out, and new water added to the mill. When the pulp had been flushed out at the end of the grind—that is, at the finish of the last ten-minute period—the rocks were removed, weighed, and several pieces, as a sample, were photographed. The cut at the right below shows the quartz rocks before and after the 40-minute tumbling. The cut at the left shows basalt pieces before and after 40 minutes of tumbling. The amount and rate of abrasion and the sieve analyses of the products are given in Table I.

Study of these data reveals two interesting facts: (1) that the rate of abrasion decreases with time of tumbling in the mill, or, in other words, rate of abrasion decreases as the rock pieces approach the spherical form, and (2) that the percentage production of minus-200-mesh material in the abraded sand increases with time of tumbling, or as the pieces increase in roundness. These facts are clearly brought out graphically in the curves A and B respectively.

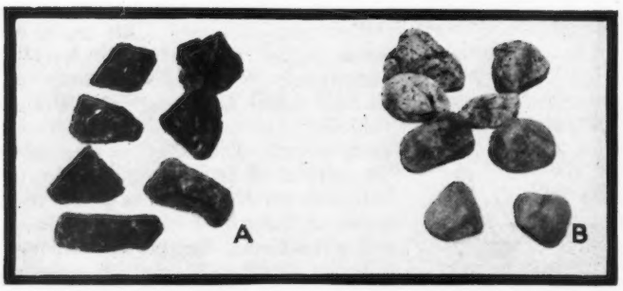
Explanation of these facts is simple. The abraded material comes almost wholly from the sharp peaks, edges, and corners of the rock pieces, and inasmuch as these are most numerous on the freshly broken pieces, the rate of abra-

Table I—Quartz Rock Mill Data

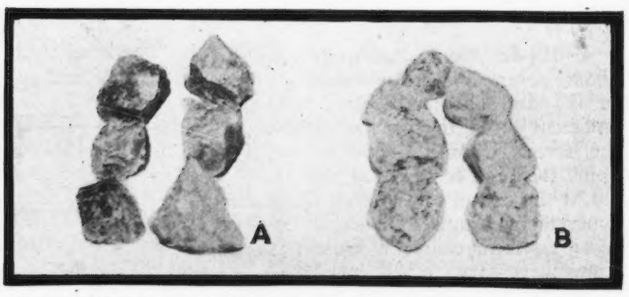
Time of Rotation Min.	Weight of Rock, Troy Oz. Start	End of Run	Amount Abraded, Troy Oz. Wt.	%	Screen Analysis of Abraded Product, per Cent +28	35	48	65	100	150	200	—200
0	1,900	.....	...	....	..	..	..	..	..	..	..	..
10	.....	1,772	128	6.8	18	9	11	15	8	6	7	26
20	.....	1,710	62	3.3	24	5	7	12	7	8	6	31
30	.....	1,672	38	2.0	13	5	7	10	7		10	41
40	.....	1,641	31	1.6	7	4	6	12	7		9	46
40	1,900		259	13.7								

Table II—Screen Analysis of Crushed Product Made in Test No. 2

Mesh			Weight Gm.	%	% Cum. On	% Cum. Through
	+	6	19.0	19.00	19.00	80.00
— 6	+	8	5.0	5.00	24.00	75.00
— 8	+	10	4.0	4.00	28.00	71.00
— 10	+	14	4.0	4.00	32.00	67.00
— 14	+	20	4.0	4.00	36.00	63.00
— 20	+	28	5.5	5.50	41.50	57.50
— 28	+	35	7.0	7.00	48.50	50.50
— 35	+	48	7.5	7.50	56.00	44.00
— 48	+	65	10.0	10.00	66.00	34.50
— 65	+	100	5.0	5.00	71.00	29.00
—100	+	150	5.5	5.50	76.50	23.50
—150	+	200	6.0	6.00	72.50	17.50
	—	200	17.5	17.50	.....	.....
			100.0	100.00		



BASALT FRAGMENTS before and after tumbling for 40 min. in a 35-in. grinding mill. This is shown at "A" and "B," respectively. The explanatory data are given in the accompanying curves



QUARTZ FRAGMENTS before and after ("A" and "B," respectively) tumbling for 40 min. in a 35-in. grinding mill. The data that were obtained are presented in the accompanying graph

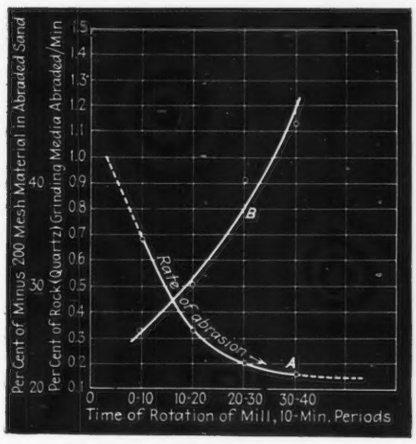
sion naturally should be greatest at the start of a tumbling treatment and should fall off as the pieces become rounded. The increase in the percentage of minus-200-mesh material in the product with time of tumbling is accounted for by the fact that the amount of abraded sand is increasingly less with each ten-minute period of milling, and as the pieces become rounded they also become increasingly effective as grinding media.

Test No. 2—The conditions of this test were as follows: Mill, 35 in. in diameter by 8 ft. long; speed, 36 r.p.m.; quartz grinding media, 1,975 troy oz.; feed, 275 oz. of plus-¼-in. quartz; water, 550 oz.; and time of rotation, ten minutes.

At the end of the run, the weight of the quartz grinding media was 1,787 troy ounces, a consumption of 188 oz., or 9 per cent. The total weight of the crushed product washed from the mill was (275 + 188 =) 463 troy ounces.

Screen analysis of the crushed product is shown in Table II.

The most interesting feature of the data of this run is the effect of the addition of quartz sand on the rate of consumption of the quartz rock. In Test No. 1 the consumption of rock during the first ten minutes of rotation was 128 oz., or 6.8 per cent, whereas, in this test, the consumption was 9 per cent.



RATE OF ABRASION decreases with time of tumbling in the grinding mill. This is shown by Curve A. Curve B shows that percentage production of —200 mesh material in the abraded sand increases with time of tumbling

In view of the considerable effort made and money spent on rock milling in the past few years, and of the possible commercial importance of rock milling when finally developed, experiments of the kind outlined in the foregoing, and data obtained therefrom, are of some interest, although of extreme preliminary character. Not much in the nature of the fundamentals of this process of grinding is known. Experimental study is difficult and expensive because of the large size of machines and the materials and products involved.

Mineral Policy Planning Meets Obstacles

As a result, the many important questions relating to the supply of strategic minerals or to the lack of them are left up in the air

R. S. McBride

Colorado Building
Washington, D. C.

FORMULATION of policies regarding mineral development is being undertaken by the National Resources Committee, of which Secretary Ickes is chairman and Dr. Charles W. Eliot II, executive officer. The former agency, Planning Committee for Mineral Policy, was abolished on Jan. 1 by Presidential order, and its functions and all duties were transferred. The change was made for a number of reasons, not the least of which is apparently the fact that the old mineral policy committee had not aggressively pursued its assigned task during the past year. It had, in fact, done little since issuing its first report, which appeared in the volume of the National Resources Board issued December, 1934. (See *E.&M.J.*, January, 1935.)

No announcement had yet been made late in January of the personnel of the new subcommittee for mineral policy making which is to be organized. Two schools of thought have debated this subject. One group objects strenuously to having fact-finding personnel as members of the policy-making committee. The other group believes that all divisions of Government work affected by mineral activities should be part of the policy-making body. The decision when reached will be largely influential in determining the course of even the fact-finding work of the United States Geological Survey and the Economics Branch of the Bureau of Mines. This influence will be twofold, but most important will be the question as to who holds the purse strings for these and related activities. Two factors account for this anomalous situation. In the first place, few except the mineral economists are sufficiently interested and well enough informed to press these problems toward solution. In the second place, there are two schools of thought—one of them anxious to legislate first; the other desiring to investigate, and then later let others plan legislation on the basis of the committee's factual surveys. The result has been a standstill.

No appropriation is currently available for fundamental studies of mineral economy. This is particularly strange in view of the importance of this subject and of the way in which it fits into the other programs of the New Deal. The President himself senses this situation; and he probably had it in mind at least incidentally when, speaking primarily of agriculture, he enunciated what could really be called a major plank of his platform for the period 1936-1940. On that occasion he said:

"The success that has attended and is attending our efforts to stem the depression and set the tide running the other way cannot blind us to the necessity of looking ahead to the permanent measures which are necessary to a more stable economic life. We are regaining a more fair balance among the groups that constitute the Nation and we must look to the factors that will make that balance stable."

Yet no money has been allotted either in current budgets or from the emergency funds which could well have given a great impetus to the much-needed studies. Even the projected mine survey (See *E.&M.J.*, November, 1935, p. 576) fell by the wayside at the last minute as a result of changing plans for emergency work relief. Nor is there anything else in prospect, except the conventional Census of Mines and Quarries. This will be taken during 1936, as an extra census in what has hitherto been a decennial series. But it will tell Uncle Sam nothing fundamental as to the needs of mineral industry, and no more than he already knows of the resources he has with which to meet these needs.

International movement of mineral commodities is essential to the well-being of every nation of commercial consequence. And many of the smaller

nations which are important producers find their standards of living distressingly lowered when this trade in the commodities which they produce is either temporarily interrupted or seriously slowed down. The hubbub surrounding the League of Nations' effort to curb oil movement to Italy is but a gentle zephyr compared with the hurricane which would inevitably arise should major-metals movement be actually interfered with.

Almost every nation without imports of metals would become industrially sterile and militarily impotent. The charts which formed an important section of the February issue of *E.&M.J.* picture graphically these problems as they affect the United States with respect to a dozen of the most important metals. A discussion of each of those metals deserves much space and still further Government investigation. In a world so disturbed as that in which we now live, it is an amazing thing that neither the using industries nor the military and naval authorities have pressed successfully to active prosecution the wanted investigations. The effort of the War and Navy departments in Washington is but a feeble gesture; and the facts on which the military plans are now necessarily based are at best fragmentary and inadequate.

Most questions of strategic mineral supply are just as important in peace times as during military disturbances. The competition of the industries of any nation with those of the rest of the world demands as favorable a supply as possible of raw material. When raw material becomes too expensive, products made therefrom cannot be sold profitably in the competitive marts of the world. For this reason commercial control of raw-material supplies is particularly important to American producers, not only those who make primary metals or their early derivatives, but also those whose products are far more advanced in manufacture and into which the metals or non-metallics ultimately go.

British and American interests dominate the supply of a very large number, in fact substantially all, of the metals and minerals of great world importance. Only a few, like quicksilver, are under the domination of governments or nationals of other powers. Sometimes the control is territorial, in other cases it is through corporate development or by domination of the merchandising or smelting enterprises. During peace times it is unimportant how the control of price and markets is had. The important thing is that this control be not held against the industry of the nation by unfriendly or unreasonably competitive trade interests.

A great many persons observing this peace-time domination by English-speaking enterprises have said that United States industry has nothing to fear. In a sense this is true. The cooperation with British interests is usually feasible and profitable. But it is not altogether satisfying to many that there should be so little reliable information as to the exact status of these situations, especially those in which large groups of American manufacturing interests are involved or by which they could be unfavorably affected.

Still more important just now is the factor of secondary supplies and the recycling of metals by industry. To a considerable extent the reserves of metal in use become strategic resources. The rate at which such metal returns to the channels of trade is important. With respect to a few metals America has such reserves of almost dominating importance as far as national policy or security are concerned. But there, too, the facts are not sufficiently complete and reliable to warrant conclusions that can stand sharp critical attack.

Inflation—Speculation

There are a variety of types of inflation which are affecting significantly the supplies of minerals. One does not need to assume uncontrolled currency inflation to realize that the strategic-mineral supply of a nation is influenced. Even those mild forms of credit inflation, and those more positive moves of the New Deal for goods price inflation, have modified world movement of strategic minerals and metals. Anything which affects exchange rates also must be considered important in mineral world trade.

Still more disturbing with respect to those strategics which come from the Orient, like antimony and tungsten, have been disturbances in the price of silver. When such speculation as has attended this price manipulation enters into trade, the meaning of goods prices becomes uncertain. This is particularly true when great nations are themselves entering into metal marketing much as if they were speculating. And the end is not yet in sight.

Quite a number of problems in strategic-mineral supply have closely approached solution so far as the United States is concerned. A few of these problems are fully solved; for example, no one now would consider potash, natural nitrates, or fluorspar as longer entitled to "strategic" rating, nor would gypsum or pyrites usually be so classed. Other recent developments of mineral supply in the United States raise other equally important questions, on most of which it would be difficult to get anything like unanimous agreement, because of lack of adequate official facts. In some cases the questions imply progress toward self-sufficiency; in other cases the trend seems to be toward greater consumption, and consequently greater foreign dependence.

Anyone who wishes to exercise himself with mental gymnastics on these subjects can well undertake to answer, even to his own satisfaction, questions like these:

1. Has domestic development of vanadium made United States self-sufficient?

2. What is the commercial and strategic significance of newly opened reserves of chromium in the Philippine Islands?

3. Will beer in cans upset the trend toward trade balance in tin?

4. What is the commercial significance of newly opened Southern deposits of china clay? Also, the new refractory clays of Alabama?

5. Will the Mid-continent supplies of fluorspar adequately furnish American industry with synthetic cryolite?

6. Where do we stand on barite, magnesite, talc, or soapstone?

7. What stocks do we have on hand of the various deficiency minerals; and, more importantly still, how can we effectively and economically augment these stocks?

By the time any reader has answered this group of questions he will have discovered two or three more unanswered ones to replace each one solved. The deficiency-mineral problem will, therefore, remain for a long time a puzzling one; one on which American industry should work vigorously at all times.

A harbor in the Philippines, in eastern Luzon, which is likely to become a shipping point for chrome ore

MODERN 100-TON FLOTATION MILL at Spring Hill mine. Surface buildings are grouped within 100-ft. radius of the shaft

Modernization Revives an Old Grass Valley Mine

John B. Huttl
Assistant Editor

Three-year program of underground exploration and development, followed by erection of a modern flotation mill, rehabilitates the Spring Hill mine, first worked in the 'seventies

ERECTION of a model surface plant and the start of active production at the Spring Hill mine on Sept. 1, 1935, marked the culmination of a three-year period of intense and systematic exploratory and development work. The property is situated about 1½ miles northeast of Grass Valley, Calif., adjoining the Idaho Maryland mine to the north, and is operated by Spring Hill Gold Mines, Inc., a closed corporation headed by D. E. McLaughlin, of San Francisco, with whom are associated Mrs. Flora Cloman, of Washington, D. C., and H. R. Plate, resident manager at Grass Valley. The Spring Hill mine is not a new discovery. It was worked in the early 'seventies through two shallow incline shafts, but had remained idle since until the present company secured an option on the property in July, 1932, and immediately started unwatering the Nathan shaft. The adjoining Golden Gate mine was acquired by the company in 1933.

On completion of preparatory rehabilitation work, the company commenced to sink the old Nathan shaft a distance to what was previously known as the 900 level. Following this a series of drifts and crosscuts were driven on the 300 and 700 levels to the east and west limits of the property. Subsequent operations included sinking a 200-ft. winze to the old 1,100 level, exploration of the footwall and hanging wall of the vein by means of a small diamond drill, connection of the 300 and 700 levels of the Spring Hill mine with the Golden Gate workings, and straightening of the Nathan shaft to an even 45 deg., which caused a loss of 200 ft. in actual measurement from the new collar to the levels mentioned. The connection on the 700 level reached the Golden Gate mine about 40 ft. vertically below the 1,030 level. Apart from the sinking operations explained previously, the complete development program involved driving of about 8,000 ft. of drifts, crosscuts, and raises, and 10,000 ft. of diamond drilling.

The flat north-dipping Spring Hill vein occurs principally in serpentine, though in many cases a footwall or a hanging wall of diabase is found in the vicinity of oreshoots, the diabase usually forming a more favorable wall rock for the better grade of ore. The quartz proper varies from 18 in. to 2½ ft. in thickness, and the mineralized diabase is 5 to 15 ft. thick. The ore extracted and sent to the mill is of somewhat lower grade than is mined in the district, and averages about $10 in gold per ton.

Owing to the flat dip of the vein, the ore broken in the stopes will not run freely, thus making necessary use of a stoping method similar to that employed at the neighboring Empire mine. The stope is carried as narrow as possible and timbered with occasional posts and stulls, the broken ore being mucked down into the loading chutes on the haulage level by ½-cu.yd. V-type steel scrapers actuated by I-R double-drum Tugger hoists. Drilling in the stopes is done with Gardner-Denver S-55 mounted jack-hammers and Gardner-Denver wet stopers. In drift and crosscut operations Gardner-Denver D-79 drifters are used. Timken detachable bits are used exclusively.

From the loading chutes the ore is trammed in trains of nine 1-ton cars drawn by a Westinghouse 1½-ton storage-battery locomotive to the storage pocket at the shaft. Ventilation of underground workings is natural, the air being received through the Golden Gate and Day shafts, situated east and west respectively of the Nathan shaft, which is upcast. Mine water is pumped by Cameron two-stage centrifugal pumps on the 300- and 700-ft. levels to the drainage tunnel, which is 60 ft. vertically below the collar of the Nathan shaft. All shaft

stations in the mine are electrically lighted.

As to the new surface plant and 100-ton flotation mill, the company has done all that makes for economical and safe operation. The feature that most excites the interest of the visitor is the novel layout of the surface-plant buildings proper. To meet the requirements of the Industrial Accident Commission, they are grouped around the main shaft in a circle with a radius measuring 100 ft., the shaft forming the center or hub of the circle. The flotation plant is of the one-man-per-shift type, and the diverse equipment is arranged in a manner as to permit observation from any point desired in the interior of the concentrator.

The crushing plant adjoins the steel headframe to the east. The main shaft contains two hoisting compartments and a manway, each measuring 4x5½-ft. inside the timbers. Hoisting of ore is done in 1½-ton skips suspended from ¾-in. Roebling cables and operated by a 125-hp. Vulcan double-drum hoist. The 35-lb. rails upon which the ore skips operate are spaced 31 in. The A-type steel headframe is 71 ft. high, and is equipped for dumping automatically into a 100-ton circular steel bin with a conical bottom, from which a 36-in. steel plate apron feeder discharges the ore over a steel grizzly, spaced 1¼ in., into a No. 4 Gates gyratory crusher. Waste rock hoisted in the skips is disposed of separately by an automatic dumping device built into the skip tracks at a point about 30 ft. below the top of the headframe.

The grizzly undersize and also the crusher product go via a 16-in. inclined-belt conveyor, measuring 154 ft. between centers, to the 200-ton steel fine-ore bin, which is in shape and construction identical to the one at the crushing plant.

The flowsheet of the mill practically follows that of the newer flotation plants in the Grass Valley-Nevada City district. From the fine-ore bin the ore is fed by an automatic feeder and belt conveyor to a 6x5-ft. Hendy ball mill driven by a 100-hp. Westinghouse motor, and operating in closed circuit with a 54 in. by 21 ft. Dorr classifier. The Denver Equipment unit cell interposed between the ball mill and the classifier is used at the present time as a trap for free gold and floating coarse sulphides. Minus 64-mesh classifier overflow goes to a steel sump tank, whence it is pumped by a 2-in. Wilfley pump to a 6x10-ft. conditioning tank equipped with a Devereux agitating mechanism. From here the pulp flows to a series of five 36-in. Fagergren flotation machines for further treatment.

Concentrates from the first cell go direct to a 10x8-ft. Dorr thickener; the middlings from the remaining four cells flow by gravity to the steel sump tank mentioned previously, to be pumped back to the conditioning tank by the Wilfley pump. The thickened concentrates receive final treatment in a 3x4-ft. Oliver continuous filter.

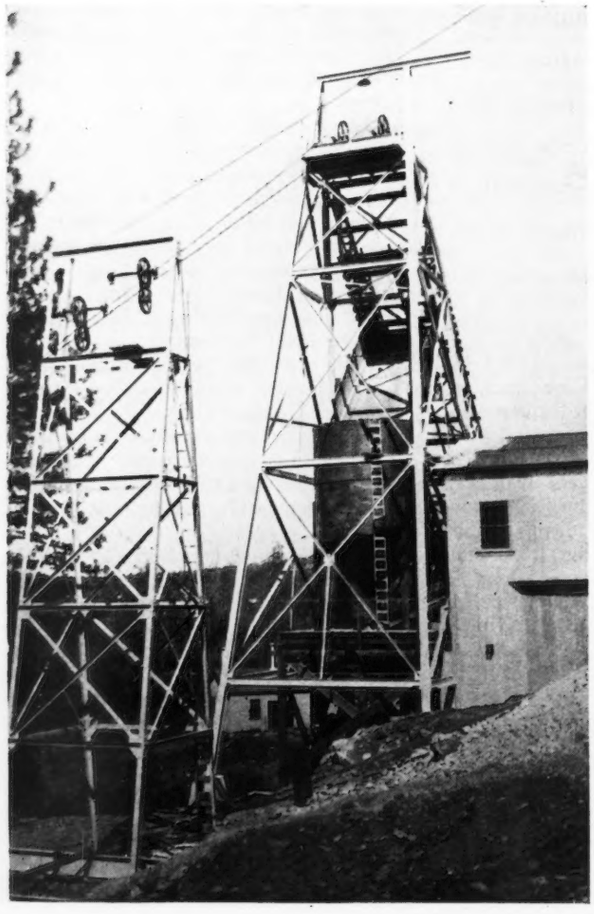
Tailings from the flotation units are split, one stream being passed first over a Plat-O table before going to the tailings dump in conjunction with the other stream. This is done to check the action of the flotation cells. Head and tailings samples are taken simultaneously at specified intervals by electric-driven automatic samplers that are installed just above the ball-mill feed belt and behind the Plat-O concentrating table.

Reagent Consumption

Reagents used are No. 208 and No. 301 of American Cyanamid Company manufacture, cresylic acid, and starch. Consumption per ton of ore treated is as follows: Reagent No. 208, 0.02 lb.; Reagent No. 301, 0.15 lb.; cresylic acid, 0.015 gal.; and starch, ½ gal. of 4 per cent solution. Ratio of concentration is approximately 50 to 1. Total recovery is 95 per cent. Finished concentrates assaying about $600 per ton are shipped to the Selby smelter at San Francisco.

The mill is operated in three shifts, with one man employed on each shift, and is now treating about 110 tons of ore a day. It was designed and erected under contract with the Western-Knapp Engineering Company, of San Francisco. Water that is necessary for plant use is obtained from the Nevada Irrigation District.

The other surface plant buildings grouped around the main shaft include a blacksmith shop, equipped with a Gardner-Denver sharpener, an oil-fired drill-heating furnace, an I-R detachable bit and shank grinder, and sundry blacksmith and repair tools; a storehouse; a timber framing shed; a 30x50-ft. fireproof, steam-heated change house accommodating 60 men, and containing six showers, wash basins, and separate rooms for the work and street clothes of the employees; an assay office; a general office; a central heating plant; a compressor plant; and a hoist house. Air-generating equipment available at the compressor plant include a 700-cu.ft. Worthington two-stage compressor driven by a 125-hp. G-E synchronous motor, and a 280-cu.ft. Gardner-Denver high-speed compressor actuated by a 60-hp. motor through a V-belt drive. The hoist house contains a Vulcan hoist capable of operating to a depth of 2,000 ft. on a 45 deg. incline. It has two drums and is fitted with automatic control and safety equipment.



STEEL HEADFRAME OF SPRING HILL MINE

Ore hoisted is dumped into a 100-ton bin, which feeds the coarse crushing plant located at the foot of an incline belt conveyor

PLACER MINING MURAL—the second mining mural by Irwin D. Hoffman. This painting was displayed at the annual meeting of the American Institute of Mining and Metallurgical Engineers and was made for Gold Operators, Inc., New York, Robert Hoffman, president. The companion mural depicting underground mining operations appeared on page 611 in the December, 1935, issue of *Engineering and Mining Journal*.

NEWS
OF THE INDUSTRY

A.I.M.E. Convention Largest in Years

ATTENDANCE at the 145th meeting of the American Institute of Mining and Metallurgical Engineers, held in New York during the week of Feb. 17-21, was the largest in several years. Papers relating to geology, mineral economics, and practices in mining and metallurgy, together with reports of advance in the science of aërial and geophysical surveying, attracted large groups to these meetings. The mining of non-metallics and their increasing use in various fields of industry were subjects discussed by members from the Southern and Central States interested in this growing phase of the mineral industry.

The officers elected for the year were John M. Lovejoy, president of the Seaboard Oil Company, who succeeds Dr. Henry A. Buehler as president of the Institute. Mr. Roland C. Allen, vice-president of Oglebay, Norton & Company, and Henry Krumb, consulting mining engineer, were elected vice-presidents.

Following registration on Feb. 17, the morning sessions were devoted to mining methods and non-ferrous metallurgy. The status of hydraulic mine débris in California was discussed, and it was generally considered the more that farmers become interested in gold mining the more broadminded they become about silt deposition. A paper stating the merits and practicability of a dragline dredge operation in California was also given. The increasing use of aërial photography in geological mapping has brought about refinement in this field. Mr. Eliel, of Fairchild Aërial Surveys, said that the airplane can now be equipped with a device known as the solar navigator which will keep the plane within one quarter of a degree of a perfectly straight course when taking geological or commercial photographs from the air.

A short but interesting talk on nozzle crushing experiments was given by R. S. Dean, of the United States Bureau of Mines, who indicated that the results so far obtained, though rather few in number, indicate that the nozzle may be looked upon as a simple, high-capacity, fine-grinding appliance. The cost figures would seem to be prohibitive under some conditions, but further study of the nozzle may well reduce the cost figures materially.

Gold was the outstanding metal discussed in connection with geology, mining, and milling, and pertinent facts about the economics of this industry were given by John J. Croston in a paper stating that gold mining was a billion-dollar business, with preliminary estimates indicating that over 30,000,000 oz. were produced in 1935. Mr. Croston said: "A careful consideration of the background factors both economic and political, here and abroad, leads to the conclusion that gold will not go back to its old price." Concerning the added tonnages to world gold ore reserve due to present value of $35 an ounce, it was brought out that the world's tonnage of developed ore has been increased about 70 per cent in the interval between the old price and the present, notwithstanding withdrawals for crushing, and the metallic content is about three years of production at the present rate. "In the main, however, the general conclusion that revaluation has greatly affected the reported ore reserves is valid and the actual effect on the total potential reserves known or reasonably expected to exist of a tonnage and grade not yet ascertainable will be far greater in per cent than even its effect upon reported reserves. If costs stay reasonably near present levels, reserves will have been enormously increased. If costs soar, much of the material now classed as ore will revert to unpayable ground."

In the field of milling practice, papers were confined principally to flotation of gold ores. The numerous small mills scattered throughout the Comstock lode in Nevada were discussed, and the interesting fact brought out was that many small mills have numerous variations in their flowsheets in treating ore from the same district. It was considered, however, that in some cases this is justified, but that probably greater

(Continued on p. 149)

Copper Queen Mine, in Arizona, Completes Sinking Junction Shaft

Three Mines Produce All the Ore Sent From Copper Queen Branch to the Douglas Smelter—Mining Activity Increases in the Salome District—Tennessee Mine, Near Chloride, to Resume Operations

THE MINES of the Phelps Dodge Corporation, Copper Queen Branch, Bisbee, Ariz., are shipping to the Douglas smelter about 45,000 tons of ore per month which is hoisted from the Junction, Campbell, and Cole shafts. Development footage in the three mines is at the rate of 5,000 ft. per month. Sinking of the Junction shaft from the 2,300 to the 2,700 level has been completed, and work has started preliminary to prospecting the 2,433, 2,566, and 2,700 levels. Mechanization has been extended to both stoping and development work. Electric slusher hoists and scrapers are used in all stopes and Eimco-Finlay loaders in level work. Hand-fed drilling machines have been replaced in part by automatic-feed machines. Approximately 1,000 men are employed.

✦ Preparations are being made by E. E. Campbell, owner, and R. L. D'Arcy, manager, to resume operations at the Tennessee mine, at Chloride. The mine is developed by a 1,400-ft. shaft and a winze to the 1,600 level. The present equipment includes a 150-ton concentrator installed by Monarch Lead Company in 1929, but this was operated only a short time.

✦ Harqua Hala Gold Mines Company has taken over the property bearing that name near Salome. Power shovels, tractors, and a diesel plant have been ordered for mining. A Hardinge-Hadsel mill and Denver Sub-A flotation cells will be the equipment for the 100-ton pilot plant. C. H. Norton is president of the company. E. M. Elliot, secretary, will be in direct charge at Salome. A new lease has been granted Miles M. Carpenter on the tailings from the old mill, which he has been treating under the name Harqua Hala Cyanide Mill. About 15,000 tons of tailings remain in the dump.

✦ Oro Flame Mining is installing another ball mill to increase tonnage from 40 to 65. The shaft is now down 235 ft. Production is from the 50- and 100-foot levels, with the 200 level under development. John L. Alexander, of Prescott, is mine superintendent.

✦ The Atlasta mine, near Morristown, will begin shipments to the Magma smelter soon. The shaft is down 170 ft. Work is directed by Moncrieffe Cameron and Eugene Duvaul, Box 1753, Phoenix, Ariz.

✦ New Year mine, at Congress Junction, is showing a wide vein of rich ore, according to O. A. Randall. The mine had not been opened for forty years.

✦ Another Silver Queen which became a gold mine is reported from Prescott. R. M. Hanson and Jack McMahon have taken nearly seven pounds of gold from the mine in the two weeks since making the strike. The mine produced some rich silver ore when it was discovered about 50 years ago.

BLACK EAGLE MINE of the Tom Reed Gold Mines Company, near Oatman, Ariz. The ore goes via aërial tram to the mill at Oatman

✦ The Samoa mine, north of Kingman, is shipping from the orebody developed on the 300 level. Leonard Hoffman is manager, with Woody Alger in charge of development.

✦ Swastika, at Cleator, reports a successful two-week run of the new flotation mill. Production in 1935 was over 100,000 oz. of silver. Production during the current year is expected to be increased materially.

✦ The old Congress mine, at Congress Junction, has been sold to the Congress Mining Corporation. Gerald Sherman, of Brooklyn, New York, is expected to direct reopening of the property.

✦ Arizona Consolidated Copper Mining has located a large lens of lead-silver ore on the 140-ft. level of the Chief mine, 7 miles from Patagonia. Development work is under direction of Bert Logan.

✦ San Francisco mine, in Cedar Valley, near Kingman, has been dewatered and the new mill placed in operation under supervision of W. H. Munds, formerly mill superintendent at Boriana. Both tailings and mine ore will be treated.

✦ McQuire mine, south of Kingman, is now shipping ore from the open-cut mine to the Tom Reed mill at Oatman.

✦ The Octave Exploration, operator of the Bishop mine, at Octave, is reported to have acquired the Beehive mine and the Rebecca mill. C. T. Sullivan is general manager.

✦ Johnson Gold Mine, at Octave, is mining and milling 35 tons of ore daily. F. W. Dryden is mine superintendent and H. B. Morton, mill superintendent.

✦ The Golden Door mine and Merritt mill have been purchased by J. L. Harper, who recently acquired the Dixie Queen mine, in the same section of Mohave County, north of Kingman.

✦ The Rosebud claims in Yuma County have been acquired by L. M. Snow, a Colorado mining man, who is supervising construction of a road and camp and installation of a diesel engine to supply power for shaft sinking and operation of a pilot plant.

✦ In the annual report to the stockholders, the United Verde Extension Mining Company said that the smelter is expected to start a run about March 1. It seemed doubtful whether conditions will warrant a second smelter run, but definite decision on this question will be made at a later date.

✦ Two shifts are employed in drifting on the 400 level of the Morgan Gold Mines, at Sells, by J. B. Hedrick, lessee, under Tom Frazer, mine superintendent.

(Continued from p. 147)

use of cyanidization would give greater percentages of extraction. Experimental results of the influence of sodium sulphide, alkalis, and copper sulphates on the effect of xanthates at mineral surfaces comprised the fourth of a series of papers on flotation. Other papers presented dealt with electrocapillary amalgamation, milling developments at Benguet Consolidated.

The increasing use of aluminum and the future of high-strength alloys are subjects of keen interest to the mining and metallurgical engineer. Dr. Francis C. Frary, director of research, Aluminum Research Laboratories, New Kensington, Pa., stated that, in its first fifty years of history, aluminum has slowly but steadily become an active competitor of iron, copper, and zinc. The next ten or fifteen years may determine just what important place aluminum will occupy in the fields of metals. A joint symposium of the Iron and Steel section and the Metals Division of the Institute was also held.

At the annual dinner Clinton Hoadley Crane, president of St. Joseph Lead Company, received the William L. Saunders Mining Medal and Robert Peele was presented with the certificate of honorary membership. C. C. Henning received the Robert W. Hunt prize and Francis Hearne Crockard was presented the J. E. Johnson, Jr., award. Dr. Henry A. Buehler acted as toastmaster and introduced John M. Lovejoy, president of the A.I.M.E. for 1936.

About 250 persons took the excursion on Feb. 21 to Schenectady, where they were the guests of the General Electric Company for the day.

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Brazilian Mining Engineers And Geologists Organize

A group of mining and geological engineers at Rio de Janeiro recently organized the Instituto Brasileiro de Mineracio e Metalurgia. The aims and activities of the I.B.M.M. are reported to be similar to those of the A.I.M.E., modified, however, to suit local conditions. The Instituto will cooperate with the Rio de Janeiro Section of the A.I.M.E., which will represent the Instituto in matters of a foreign nature. Members of recognized foreign technical societies may join.

The I.B.M.M. will publish, in Portuguese, a bi-monthly review to be known as the "Revista de Mineracao e Metalurgia" and will contain English abstracts of important articles. Foreign engineers are invited to join the organization and information can be obtained by writing to Dr. Djalma Guimaraes, Serv. Fom. Prod. Mineral, Avenida Pasteur 404, Rio de Janeiro; Dr. Pedro de Moura, Serv. Geol. e Mineral Avenida Pasteur 404, Rio de Janeiro, or to Mr. Mark C. Malamphy, Prudente de Mores 451, Rio de Janeiro, Brazil.

The Walker Mine, in California, Dewatered to Lower Levels

Examination of Areas Formerly Submerged to Be Followed by Deeper Operations—Telegraph Mine, in Sierra County, Now Equipped for Mining After Long Shutdown—Greater Development Planned by Carson Hill Gold

WALKER MINING COMPANY has dewatered its property in Plumas County to the 1,000-ft. level and is now making preparations for resumption of extensive work below the 900-ft. level. The Walker mine was reopened last fall after an idleness of nearly four years caused by the low price of copper. Milling operations are conducted on a full-time basis. Other work in progress at the property includes sinking of a four-compartment shaft. H. A. Geisendorfer is general manager.

✦ A group of claims situated just east of the Middle Buttes mines and northwest of the Cactus Queen and Silver Prince properties have been acquired by T. C. White, of Los Angeles, and exploration work is to be started soon. Frank Royer, consulting engineer, and Cleveland Taylor, both residing in Los Angeles, are associated with Mr. White.

✦ Republic Gold Mining Company, E. C. Jacobs, general manager, is considering sinking a new shaft at its Empress mine, about 4½ miles northwest of Grass Valley. The new shaft will be sunk to a depth of 1,500 ft. about 1,000 ft. north of the main shaft, now in operation.

✦ Work on the new 600-ton slime plant at the tailings plant of Kennedy Mining & Milling Company, of Jackson, is progressing satisfactorily. About 20 men are employed preparing the foundations for the tanks, classifiers, and filter presses to be installed. The plant was designed by Murray N. Colman. Its cost will exceed $100,000. E. C. Hutchinson is president of the company.

✦ The old Telegraph mine, near Downieville, in Sierra County, is scheduled to be in operation soon, after lying idle for many years. The property is being rehabilitated and equipped with mining machinery and a diesel power plant by Los Angeles interests. About 25 men are employed under the direction of J. M. Sheedy, superintendent.

✦ Increased activity prevails in the Kernville area. Mining operations have been started at the Big Blue, Lady Bell, and Beauregards properties, controlled by Kernville Development Company. Work completed recently by the company includes raising the dam 18 in. to double the flow of water in Sumner ditch, 1½ mile long, leading to the power house at the mill, where a water turbine develops 400 hp.; renovation of buildings and installation of machinery at the three mines; and the addition of a twelve-cell flotation machine at the 150-ton mill. The Big Blue shaft is being straightened and timbered and a new headframe and hoist are to be installed, which will save a 2,800-ft. haul through the tunnel. The mill is to be revamped and later, if a sufficient amount of ore is uncovered, will be moved to a more accessible location. A crew of men is now engaged sampling and assaying ore from the Big Blue mine. J. G. O'Brien, superintendent, directs operations.

✦ According to a report from Grass Valley, Idaho Maryland Mines Company is considering sinking two winzes at its property from the 2,000-ft. level for exploration purposes. The three mills operated by the company are treating more than 800 tons of ore a day. Operations are directed by Errol MacBoyle, general manager.

✦ Expenditure of about $200,000 for further development of the Carson Hill Gold Mining Corporation properties at Melones has been authorized with the objective of bringing gold production in 1936 to $1,000,000. Of the amount to be expended $60,000 is being set aside for the purchase of additional mining and milling equipment. Charles H. Segerstrom is president of the company.

✦ Early installation of a 120-ton flotation mill at the Ballard mine, near Plymouth, is planned by Ballard Mother Lode Mines, Inc., of which John Ratto is superintendent. At the mine, sinking of a two-compartment shaft is in progress preparatory to crosscutting to intercept two parallel veins. Operations have reached the 280-ft. level, where a station is now being cut. A new hoist and headframe are to be installed soon.

✦ A report from Mojave is to the effect that Lodestar Mining Company, headed by John M. Rogers, has purchased the Elephant Eagle mines, including the Excelsior, Hope, Elephant, Charity, Herman, and Oro Fino claims, and mill, well, and water rights, for $190,000. The property has been worked for several years under leasing arrangements by the Jesse Knight interests. Rogers has been working the Starlight claim of the Elephant Eagle group for several months and has driven several thousand feet of drifts and crosscuts. A new 250-ton mill is to be erected soon. J. J. Raskob, of New York City, is said to be associated with Rogers.

Mountain City Copper, in Nevada, Will Construct a Flotation Mill

Company to Spend $250,000 for a Plant to Treat Lower-Grade Ore Found Near the High-Grade Deposit—Rochester Plymouth Mines Report Finding Of New Orebody—Deeper Development for Old Mines in Goldfield

ANNOUNCEMENT has been made of plans to erect a 300-ton flotation plant at the Mountain City Copper mine of the International Smelting Company in Elko County, Nev. Estimated cost of the plant is set at $250,000. Construction will begin as soon as weather permits. Operations, it is planned, should begin next fall. Erection of the plant will facilitate the treatment of a large tonnage of milling ore that surrounds the high-grade body of shipping ore. Two roads lead from the mine, one by Elko, a distance of 90 miles, and the other by Mountain Home, Idaho, a distance of 112 miles. Recently, the company had to suspend shipments first by way of Elko, Nev., and later by way of Mountain Home, Idaho, on account of winter storms.

✦ An orebody declared to be the richest opened in the Rochester district, Pershing County, is providing uniformly high-grade silver-gold ore for the 70-ton flotation mill of the Rochester Plymouth Mines Company, on its Buck & Charley mine. Ore of mill grade, including some substantial widths of high grade, has been opened over a width of 30 ft., according to Charles Mayer, manager. The orebody lies between the old surface glory hole and the main inside shaft workings. Discovered in the early period of activity at Rochester, the Buck & Charley mine was named for the two decrepit mustangs that hauled the lucky prospectors to the district in a rattletrap buckboard. Rich ore was shipped from the mine by lessees in 1921, but the mine was abandoned from that time until last summer, when Mayer secured New York backing to reopen it. The mill is shipping concentrate regularly to the Selby smelter.

✦ Ore from the Justice mine of the Comstock Keystone Company is being trucked about two miles down Gold Canyon to the 130-ton cyanide mill of the Dayton Consolidated Company, which has taken a lease on the Justice. The Dayton company also is treating ore from the old Dayton mine, reopened last year, and was said to have relinquished an option lately on the Occidental mine on the Brunswick lode, near Virginia City. Homer Gibson is manager.

✦ Large areas are being prospected and development work is being extended at depths as great as 1,000 ft. in old mines of the Goldfield Consolidated Mines at Goldfield by the Eastern Exploration Company, newly formed subsidiary of Calumet & Hecla Consolidated Copper. Long-term leases or options have been taken on numbers of "indice" properties in the district, the latest including ground of the Jumbo Extension Company. Electric hoisting equipment of high capacity has been provided at the Clermont and Grizzly Bear shafts. Augustus Locke is directing work.

✦ Bids for construction of the proposed Boulder Dam-Pioche power line are now being scrutinized by the power district officers, who have announced that the first of PWA funds allotted for the project will be available immediately upon the closing of contracts.

Mine Stripping Continues In Extreme Cold

In common with all other sections of the country, the iron-ore mining region has experienced the coldest month that any of the old-timers can recollect, but with efficient operations of electric shovels and locomotives the winter stripping programs have moved along with only a few delays. This work of removing overburden is proving a boon to idle labor during the winter months, and will continue for another month. The open pits not stripping overburden are busy with machinery repairs, as all operators are expecting a heavy shipping program for this year.

✦ A contract has been let to S. E. Atkins Company, of Duluth, by Republic Steel Corporation, to test the St. Anthony iron-ore property between Hibbing and Chisholm about one-half mile south of the present Alexandria mine. The extreme cold weather has slowed up the progress of the two drills now in operation.

Cold Wave Forces Curtailment of Mining Operations in the Tri-State

Snow and Severe Winter Weather Hinder Production and Shipments of Zinc Concentrates and Postpone Opening of Several New Plants—The Lead & Zinc Corporation Completes Construction of Its New Mill Near Joplin

A COLD WAVE, which has had most of the nation in its grip the past month, greatly hampered activities in the Tri-State mining district. Ore production was materially reduced and construction work was brought to a standstill.

✦ Production during the last week of January reached 10,400 tons and has been progressively reduced since that time. The weekly zinc production figures follow: Week ended Jan. 25, 9,040 tons; week ended Feb. 1, 7,900 tons; week ended Feb. 8, 7,390 tons; week ended Feb. 15, 7,200 tons, and week ended Feb. 22, 6,200 tons.

✦ Several new plants have been practically completed during the past month and will be ready to operate with a week or two of warmer weather.

✦ Lead & Zinc Corporation, which completed its mill in the Chitwood district, near Joplin, just as the cold wave set in, is expecting to start operation as soon as the weather moderates, according to R. H. Hartley.

✦ The Coahuila mill of the Denney Mining Company, northwest of Carthage, has been completed with the exception of the brick covering for the three 150-hp. boilers. This work could not be completed during the cold wave. C. F. Denney expects to have the plant ready for operation during the first part of March.

✦ Cardin Mining & Milling Company, which had planned to start its No. 3 mill, now nearing completion on the Admiralty lease, at Century, Okla., will be ready to start operating as soon as the cold wave recedes, according to Henry Hartzell, of Baxter Springs.

✦ The Captain Milling Company, which recently started a new tailing mill on the Wilbur land, at Treece, Kan., has made good progress despite the cold weather and expects to be able to start operating around the first of March, according to Elmer Isern, of Miami. The Captain mill will be the largest tailing plant yet constructed in the field. It will have 48 cells, sufficient to handle around 3,000 tons of tailings a day.

✦ C. Erb Wuensch, who recently purchased the Joplin Ore Milling Company's holdings on the Douthat land, at Douthat, Okla., has completed the plant and would have started operations some time ago but for the cold weather.

NEWS FROM WASHINGTON

By Special Correspondent

THE ADMINISTRATION appears about ready to start a new campaign with reference to wages for industrial employees. High officials are convinced that they are getting nowhere on old efforts. They cite the fact that in some lines of industry the physical volume of business is going up definitely much faster than are either the numbers of men employed or the total dollar value of payrolls. This, of course, again raises the spectre of technologic unemployment.

The new effort will be to secure wage agreements guaranteeing suitable *annual* totals for the workers. The objective is, of course, an establishment of suitable buying power and appropriate standard of living for the worker's family regardless of *hourly*-wage rates. Particular emphasis is placed in early conversations on the brief periods of employment of well-paid hourly-wage construction workers. They often get distressingly small totals per year because employed perhaps only 100 days. And the mining industry is not far out of this sort of spotlight. It can well study the bogie set by high officials for the automobile industry, which has been told that it must do something to raise annual earnings per worker to $1,250.

Some very high officials think they can persuade organized labor to go along on this program, breaking down the traditional hourly-wage rate as a basis of contract and substituting minimum annual guarantees. Washington has not heard any intimations, much less official statements, from labor leaders to this effect. However, this does not make attempts at such planning either hopeless or futile.

Silicosis

As an incident to its investigation the House of Representatives Committee on Labor asked for testimony regarding silicosis from a number of the professional specialists of the Government. (See *E.&M.J.*, page 106, February, 1936.) Of this technical testimony the statement by Dr. John W. Finch, director of the Bureau of Mines, has perhaps the greatest interest for the mining industry. He described the present and prospective work of his Bureau as follows:

"At present the Bureau is concentrating its dust studies along three lines: (1) development of better methods of sampling dust in air; (2) improvements of laboratary technique, particularly in examination of extremely fine particles and in the study of composition of dust; and (3) survey of conditions in operating mines.

"Most dust sampling today is done by the impinger method. While more accurate than the devices previously used, the apparatus is large in size and awkward to handle underground and usable only by trained technicians. Therefore, the Bureau is developing a simpler, more compact device than can be used by non-technical persons.

"The finer the size of the dust, the more difficult it is to identify and measure in the laboratory, yet it is the very fine particles that are believed to be the most dangerous. Therefore, the adaptability to this problem of the newer physical and chemical procedures that have been found useful in other fields is being investigated. Microchemical, petrographic, and spectrographic methods, X-rays, fluorescence, and electrometric procedure are being applied.

"A knowledge of the dust conditions in mines and the correlation of these results with the mining methods employed leads to the introduction of those practices producing the least dust. Such surveys, begun by the Bureau in 1914, are being continued.

"Future Program of the Bureau of Mines—The Bureau has detailed plans for a comprehensive dust investigation along the following four major lines:

"1. Development of a more satisfactory device for the sampling of atmospheric dusts and improvement of laboratory procedures for determining composition, particle size, and concentration of dusts in air.

"2. In cooperation with the Public Health Service, determination of the physiological effect of air-borne dusts (a) in relation to their composition, size-distribution, and concentration and (b) in relation to time of exposure and working conditions.

"3. Survey of the dust conditions to which workers are exposed in the various mineral industries and, with the aid of the Public Health Service, determination of the effect of these conditions upon the workers exposed thereto.

"4. Study of methods for control of dust formation, for removing or allaying dust suspensions in air, and for the protection of workers.

"Value of Proposed Work to Industry—In recent years workmen have become conscious of the dust hazard and are demanding protection and better working conditions. Many employers would be glad to comply with these demands, but in the large majority of cases they do not know what they must protect against or how to effect the changes. The tremendous increase in damage suits has been reflected in insurance rates. These are rapidly becoming prohibitive in certain mining areas. This situation has created an urgent demand by both employers and employees for more accurate methods for determining the dustiness of atmospheres, for reliable information on the physiological effects of different dusts, for knowledge on how this effect varies with size and concentrations of the dust, and for development of methods for dust detection, prevention, control and protection of workmen.

"The Bureau of Mines is the logical agency to undertake a comprehensive investigation of this kind with respect to conditions in the mineral industries, owing to its knowledge of the technics and engineering aspects of tunneling, blasting, handling, crushing, grinding, and processing of harmful dust-producing rocks and minerals. It has also been a pioneer in industrial hygiene and occupational disease prevention."

Neutrality

NEUTRALITY of the United States is to be defined for the next year on much the same basis as during the past six months. Congress considered at length, and acrimoniously, both the proposal that the President be given more discretionary power and the more pacifist idea that all trade with belligerents should be cut off. It liked neither idea. Hence the neutrality legislation scheduled to expire on Feb. 29 was extended along essentially the original plan to prevail until May, 1937. The only major addition made by Congress is limitation on financing and the giving of credit for belligerent activities. These fiscal aids, like "arms, ammunition, and implements of war," are to be embargoed.

Tariff Policy

State Department officials seldom give out statements regarding the policy which governs their international dealings. Even in the matter of new trade agreements, it has been very difficult to appraise the theories on which negotiations were proceeding, beyond the most general idea that tariffs were to be lowered. Hence, industrial groups interested in tariff revision are finding it particularly important to study carefully the address given just before Christmas by Henry F. Grady, chief of the division of trade agreements, which negotiates the new international pacts.

Grady points out that the Department regards the American tariff policy as fundamentally new, providing for at least two and occasionally three rates of import duty. This new system he defines as "a conventional tariff system" imposing a lower rate of import burden on the goods of certain countries which accord their lowest rates and the most-favored-nation treatment. Under law these preferential tariffs may be as low as half the statutory or base rates. Occasionally

there may be the possibility of imposing higher than statutory rates "against countries which merit such treatment by unusual hostile action against American commerce." This new elastic commercial policy is intended "to be a departure from isolationism at a critical time, when isolation has become rampant over the world and threatens civilization itself. . . . We are to a greater degree than ever before meshing our domestic economy into world economy."

Of greatest interest are the following two paragraphs of Mr. Grady's address, as they give explicitly the several tests by which the Department may judge the desirability of lower tariff charges:

"The principles which actuate those responsible for the trade agreements program in making concessions on our tariff rates are not those of the comparative costs of production formula, for the logic and implication of this formula is the suppression of international trade. Those responsible for the program think in terms of providing increased imports in exchange for increased export outlets. In considering the matter of possible tariff lowering, the members of the committee responsible for the working out of agreements take into account such considerations as the following: In the first place, it must be clear that there should be a reduction of unduly high rates, even on competing items, if our boasted American efficiency in production has any real meaning. It is hard, moreover, to find justification for high rates in industries where our exports greatly exceed our imports. If the industry can compete successfully in markets where it has to meet foreign competition on an even footing, it should be able to meet that same competition within our own boundaries. High rates in these circumstances tempt combination of the industry to exploit the domestic consumer in the protected market, while 'dumping' the surplus abroad. Then, too, it is difficult to justify excessively high tariffs on products upon which American industries depend for essential raw materials. Finally, even an extreme isolationist could hardly justify a duty on some item of which we have no domestic production or in which the domestic production is negligible, or where, because of the nature of the product, the location of the industry or, for other reasons, increased imports could at most be only a small percentage of domestic production. This is particularly true where there are monopolistic conditions in the domestic industry and imports may serve as a healthy offset to domestic price rigidity.

"Because the program of trade agreements applies measures to increase imports, it does not follow that these measures will be taken in such a way as to seriously affect American production. The experts responsible for carrying out the details of the program take the greatest care in the selection of items. The history of trade agreements up to date, I think, demonstrates that a great deal can be done in developing our foreign trade without impairing domestic interests. The old but to us new principle of conventional tariff making is only in its beginnings, but it is to be hoped that it will be encouraged and fostered and that the powers which the Executive has been granted by the Act of 1934 may become firmly embedded in our institutional system. It is inevitable that the conduct of our international economic relations, because of the great complexity and difficulty of the task, should be entrusted to competent experts. Business interests during the past 25 years have frequently expressed themselves strongly on the matter of taking the tariff out of politics. The trade agreements program not only does this, but it does it by making possible the development of a new commercial policy which competent students of our affairs have felt for some time to be necessary."

Tin Bill

TIN-SCRAP exports from the United States may now move into foreign trade only on license from the Munitions Control Board. This small act is the only result of protracted hearings and much legislative debate in Congress which had as its primary purpose control of tin-plate scrap movement to Japan, and as its secondary one, the salvation of the detinning industry in the United States.

The bill recently passed by Congress was signed by the President on Feb. 18. It becomes effective in 60 days from that date. Under it the President has broad discretionary power to embargo exports or to grant licenses. He has named the Munitions Control Board, the agency which governs neutrality matters, as the agent to consider applications and grant export permits when warranted.

Money for Mining

Uncle Sam would prefer that commercial bankers make loans to the mining industry. This is not an altogether new attitude, but it is newly emphasized in Washington because every means available to keep down disbursements from the Federal Treasury is now being sought by the President and his administrative aids. Hence the Government would prefer to stand back of a bank loan, by guaranteeing to discount it or by insuring it, rather than to make the loan itself.

Loans from the Federal Reserve Banks do not come exactly within this proviso. But even there the quasi-Government agency which has money of its own for working capital loans is quite willing that commercial bankers do the business instead. Hence the Reserve Banks now enter into commitments to take over such paper when the commercial banker finds the discounting desirable in order to keep appropriate reserves and liquidity of his commercial institution. It should be understood, however, that loans by the Federal Reserve Banks apply only to working capital, must be limited to five years, and can be extended only on the basis of acceptable security to enterprises which are already established businesses.

At present, RFC loans can be made for new capital purposes, and are still being encouraged, but they are no more generously available than in the past. The RFC would prefer to have commercial bankers do this business. Since the organization of RFC through Dec. 31, 1935, only 37 loans have been authorized for the mining industry. In the aggregate these loans amounted to $7,145,000, of which up to January $932,000 had been disbursed. It is evident that the mining industry has been only a very small borrower at this one of Uncle Sam's pie counters.

Labor Quintuplets

Washington analysts of legislation have been critically examining the flow of bills before Congress that have to do with labor relations, wages, and business employment. They identify five distinct types, each of which deserves attention on the part of the mining industry:

1. The O'Mahoney Industry Licensing Bill provides that all enterprises that wish to do interstate business should secure a Federal license and under such license be liable to Federal regulatory supervision.

2. The Walsh Bill refers to Government contracts, providing that anyone who wishes to do business with Uncle Sam must observe in the manufacturing or merchandising involved as his rules of employment substantially those applicable under NRA.

3. The Ellenbogen Bill for the textile industry substantially reestablishes for that business a little NRA. It is significant for other industries, including mining, because if it works for textiles a like scheme will surely be applied elsewhere in due time.

4. The Van Nuys Bill is intended to restrict employers in influencing the votes of their employees in Federal elections.

5. The Black Bill, and others, would provide for a limited work week.

Some of this labor legislation is likely to become law this year. But it is doubtful whether or not any of the bills will pass in their complete most drastic form. Those who study labor legislation closely now forecast the enactment of the Walsh and Van Nuys bills but believe that the three others will go over another year.

MANNING GOLD MINING COMPANY at Manning near Mercur, Utah. The mill has been stepped up from 700 to 1,400 tons' capacity and a new kiln roaster installed for the treatment of ore and tailings

Higher Mine Output Calls for Larger Smelter Operations at Garfield, Utah

Employment Increases Somewhat as American Smelting & Refining Company Places Fourth Furnace in Operation—New Unit of Midvale Custom Ore Plant Begins Operations—United States Smelting & Refining Purchases More Mines

AS THE RESULT of increased production in the inter-mountain district, the American Smelting & Refining Company started its fourth furnace after completing an extensive program of improvements and alterations. The company is now employing 1,200 men at Garfield, compared with 350 men two years ago.

✦ United States Smelting put into operation its new unit at Midvale during the last of January, increasing the capacity of the plant from 1,000 to 1,600 tons daily. Increased capacity has been necessitated by the fact that the company has not been able to treat in the old mill the augmented tonnage from its Bingham and Tintic mines in addition to larger shipments of custom ore.

✦ Another transaction of major importance was consummated recently when the United States Smelting, Refining & Mining Company paid $100,000 to complete the purchase of property in East Park City. The sum of $50,000 was paid to the New Park Mining Company, $40,000 to the Glenallen Mining Company, and $10,000 to other groups. This action followed a decision of the District Court of Wasatch County confirming the title of the New Park Mining Company to property in dispute between the New Park Mining Company and the Glenallen Mining Company. The property purchased by the smelting company comprises 160 acres of land—the Lookout Mountain and the Hardup groups—adjoined on the west by the Burns group, purchased by the smelting company last October. The United States Smelting Company plans to work its new properties through the Star of Utah tunnel of the New Park Mining Company.

✦ Operations at the Park City Consolidated Mines Company property at Park City have been expedited by the completion of a connection between the 900 level of the mine with the Ontario Drain No. 2 tunnel. This connection removes the necessity of pumping water in the Park City Consolidated from the 900-ft. level. Two new oreshoots were recently opened above water level, one in the Crescent and the other in the Silver fissure on the 700. The Crescent oreshoot, opened for approximately 100 ft. on its strike, carries high silver values; the Silver fissure oreshoot has been opened for over 50 ft. Work is also being carried on in productive areas below water level.

✦ Development of the Tintic Standard Mining Company in its East Tintic Consolidated property, near Eureka, has reached an interesting stage. A drift from the 1,350-ft. level of the Eureka Standard is being extended through the Ophir limestone to reach the Eureka Lilly vein and other vital objectives.

✦ Chief Consolidated Mining Company is carrying on development work in its Apex Standard and other Tintic properties. Six headings in the Apex Standard are being carried forward. Chief Consolidated reports net income from ore sales during 1935 of $156,472.83. A total of 18,734 tons of dry ore having an average net value of $8.35 was mined at an average total cost of $7.66 a ton. Net income of Chief Consolidated, Plutus Mining Company, and Eureka Machinery & Supply Company amounted to $186,627, compared with a net loss of $65.575.19 for the year before. During the year, the company sold its Eureka Lilly property to Tintic Standard for $343,662.20. The company starts the year with a cash balance of approximately $300,000.

✦ Control of the Frisco Lulu mine has passed to the Bonanza Mining Company, of which George H. Ryan, of Salt Lake City, is president and manager. To secure stock control of the mine, the Bonanza company agrees to spend $29,000 in development work. The Frisco Lulu adjoins the Horn Silver on the south. Work in the mine is expected to solve the problem of whether the famous Horn Silver orebody extends into the Frisco Lulu. A shaft has been sunk to the 700 level in the Frisco Lulu. Below the 400 level, the shaft is caved.

✦ At Ophir, the Hidden Treasure and the Utah Ophir are carrying on development work under favorable conditions. Until recent heavy storms, the Hidden Treasure shipped 1,500 tons a month and employed an average of 30 men. The Utah Ophir Company is extending its Prince of Wales tunnel to intersect at depth the orebodies opened in the Commodore tunnel above. Leasers are working in the Kearsarge, the Wandering Jew, and the Brooklyn mines. A body of silver-lead-gold-copper ore has been opened up in the Silver Consolidated Mines Company property, according to C. M. Zabriskie, manager, in the Kearsarge bed.

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New Concentrator in Korea

The new crushing plant and concentrating mill of the Nurupi Kozan Kabushika, Kaisha, Korea (Chosen Syndicate, of London), which will have a capacity of treating 700 tons of gold ore per day, is nearly completed and will be operating in April, when the changeover from the old mill will be effected.

Canadian Mining Industry Awaiting Federal Budget Including Mine Taxes

Assurance Given by Ontario and Quebec That Mine Levies in Those Provinces Will Not Be Increased, but Federal Imposts Remain Uncertain—Mines in Nova Scotia Expanding Operations—Radium Concentrates Shipped by Plane

THE QUESTION of mine taxation, though not yet completely settled, is becoming better defined. Recently, Premier Hepburn announced that there would be no change in Ontario's mine taxation, which has remained on a stable basis for the past 25 years. Similarly, the Hon. J. E. Perrault, Minister of Mines for Quebec, has announced that the mine taxes of the province will not be increased. The Federal Government is the chief mine-taxing authority, and no announcement as to the rate of its imposts is likely to be made before the annual budget is put before Parliament. Meantime, the Hon. T. A. Crerar, Federal Minister of Mines, has reiterated his belief that a stable policy of mine taxation is the object of the Liberal Government and that it will confer a marked benefit on the industry. Speaking to a distinguished assembly of mining men, bankers, and industrialists in Montreal at a banquet held in his honor, Mr. Crerar reaffirmed his belief that the mining industry during the next ten or fifteen years can be developed to such a degree as to insure a period of prosperity throughout the Dominion. He advocated popularizing the idea of mining so that it might draw from the people of Canada an intelligent and widespread support. Already the first phase of the development in the 1,000-mile stretch of mineral lands eastward from Flin Flon across the northern parts of Manitoba, Ontario, and Quebec has given a sound and prosperous settlement that binds East and West through an area formerly considered to be an unprofitable wilderness. This mineral development has been only commenced, he pointed out, and if a sound policy of taxation is adopted, and if the Canadian public will support adequately and intelligently its further development, the reward will be a period of expansion and of prosperity similar to that which accompanied the settlement of the prairies a generation ago.

ONTARIO

✦ Falconbridge Nickel Mines in 1935 treated 302,510 tons of ore for a yield of 10,753,756 lb. nickel and 5,029,525 lb. copper, sold for $4,640,373, and commenced the separation of precious metals from refinery residues. The ore reserve at the end of 1935 was 4,059,475 tons averaging 1.93 per cent nickel and 0.91 per cent copper. The ore zone has now been opened for a length of over 5,000 ft. and the reserve is computed to a maximum depth of 1,200 ft. With over ten years' ore in reserve, the capacities of the concentrator, smelter, and refinery are now being increased by 25 per cent.

✦ The so-called East Kirkland area, about 7 miles east of the camp, has apparently produced its first mine. Bidgood, operating at 50 tons a day on subgrade ore, recently drove a long crosscut on the 500-ft. level south toward the Moffatt-Hall, where lenses of low-grade ore had been found. Within 200 ft. of the boundary an east-west vein averaging an ounce across drift width has been opened for several hundred feet, and the mill is now operating at a profit.

✦ Hollinger's 1935 output of $14,126,841 (after deduction of bullion tax of $577,783) from 1,837,153 tons ($8.00 per ton) is approximately the same as the year before. The operating cost was $9,081,272, or $4.94 per ton. The cleanup of the upper levels will continue during the present year, and probably for a year or more after that.

QUEBEC

✦ Aladen Malartic, adjoining Canadian Malartic on the east, has installed a mining plant and is sinking a three-compartment shaft with a first objective of 250 ft., to develop deposits of medium-grade ore indicated by diamond drilling. Andrew Walz, consulting engineer, of Montreal, is in charge of this program of development. Canadian Malartic, now milling 300 tons daily, is making an operating profit of $3 a ton from its $7 ore, of which over 500,000 tons is developed to the 375 level. Two more levels at 500 and 625 ft. are now being developed.

✦ The 125-ton Shawkey mill went into operation in February, after a two-year program of development that has put 80,000 tons of $12 ore in reserve. Like the other mines in the Harricana area, its values are largely in coarse gold, with uneven distribution; but, unlike some of them, the vein structure is comparatively regular. The ore is ground in cyanide, coarse gold is caught in jigs, and the standard cyanide flowsheet follows. Vincent Ryan is manager. J. R. Shawkey, of baseball fame, has financed the development and is president of the company.

✦ Another substantial exploration program in the Harricana area has been commenced on the property of Harricana Amalgamated Gold Mines, west of Lamaque, jointly by a group of which Mining Corporation is the active member. The surface showings resemble those of its neighbors Lamarque and Sigma. Diamond drilling is now under way. To the east, in Pascalis Township, Ventures, Ltd., has similarly commenced a campaign of drilling on the extensive showings of Pascalis Gold Mine.

NORTHWEST TERRITORIES

✦ Winter shipments of radium-uranium concentrate from the 75-ton Eldorado mill on Great Bear Lake are being made regularly by plane to the railroad at Waterways, Alberta, whence carload lots are shipped to the refinery at Port Hope, Ontario. Silver concentrate is being stored at the mine for summer shipment by water.

✦ Athona Mines and Consolidated Mining & Smelting are steadily exploring underground their extensive gold-bearing zones at Beaverlodge Point, on Lake Athabaska. Small mills are used to test the grade, as the values in the granitic rock are very irregular. No announcement of average results has been made as yet. A Montreal group represented by G. H. Rainville has taken over the intervening property of Athabaska Portal Gold Mines.

✦ Following satisfactory check-sampling, N. A. Timmins, Inc., has let a contract for diamond drilling the gold deposits on Outport Island, in Great Slave Lake. Leonard G. Smith is in charge.

BRITISH COLUMBIA

✦ Machinery to enlarge the mill from 150 to 200 tons' capacity has been ordered by the Cariboo Gold Quartz Mining Company and is expected to be installed by next June. It is officially reported that 17,458 oz. gold of a value of $615,275 was produced in 1935, from 43,418 tons of ore milled. The managing director, R. R. Rose, states that satisfactory results have been obtained in recent development work.

✦ The main reef drive at the "deep lead" operation of the Consolidated Gold Alluvials, at Wingdam, Cariboo district, is now being continued after a delay of a month while faults admitting slum were sealed. Campbell D. Mackenzie, general manager, states that development in inter-glacial workings is progressing toward a monthly production of 1,000 oz. of gold.

✦ Pine Grove Placers, Ltd., was incorporated as a private company recently

to develop a property on Lightning Creek about two miles upstream from the Wingdam operation. Rich values were found in the gravels of the old creek bed at the foot of a 130-ft. shaft.

✦ Employees of the Bralorne Mines, Ltd., with the approval of the company, have decided to adopt the Co-operative Committee System, which has been the basis of the harmonious labor relations of the Consolidated M. & S. Company for the past sixteen years.

✦ The new mill at the Wayside, in the Bridge River area, operated at the rate of about 100 tons a day during January, producing bullion of a value of $45,000, according to the managing director, P. E. Ritchie.

NOVA SCOTIA

✦ During the past year the Province of Nova Scotia has had six gold mines in regular production, all with small mills which treated a total of 41,350 tons for a yield of amalgamation of 9,050 oz. Two of these mines are now expanding their output rapidly. Seal Harbor Gold Mines, at Goldboro, is erecting a 200-ton all-cyanide mill, after developing above the 300-ft. level a two years' supply of ore of medium grade in deposits averaging 20 ft. in width. Greyboro Mines, at Goldenville, is doubling its mill capacity to 120 tons daily, after having demonstrated a profitable operation with its 20-stamp mill (60 tons). Its veins are narrow but are numerous and conveniently close together. At Caribou, Consolidated Mining & Smelting Company has reached 500 ft. with its exploration shaft and is commencing a thorough investigation of the numerous saddle veins to that depth, using a small mill to test the values. Montague, near Halifax, continues to treat 50 tons a day from narrow, high-grade veins.

Sunshine Mining Company, in Idaho, Preparing for Greater Production

Largest Silver Producer in United States Now Adding Another Mill Unit, to Be Completed When New Shaft Reaches Its Objective—Threatening Snowslides Near Jack Waite Mine Force Many Persons to Safety

DURING 1935 the Sunshine Mining Company, operating in Big Creek, Idaho, produced 5,878,135 oz. of silver, 120 oz. of gold, 46,000 lb. of lead, and 1,346,000 lb. of copper, from which the net smelter receipts were approximately $4,305,000, according to a statement submitted to the stockholders by Frank Eichelberger, vice-president. The 160,448 dry tons of ore sent to the mill had a head assay of 37.7 oz. silver and a tailing assay of 1.14 oz. Profits made during the year were $2,402,717.12, according to R. M. Hardy, president of the corporation. The reports shows the production of silver increased 70 per cent and earnings 110 per cent, notwithstanding the extraordinary rehabilitation expenditures made at the mine. Manager Eichelberger states that a new 600-ton unit is being added to the mill and will be completed this spring. Milling capacity will then be more than 1,000 tons daily.

✦ Danger from snowslides has again caused the management at the Jack Waite mine to stop work and move the 40 miners and their families out to places of safety. High winds of blizzard proportions created a grave menace in exposed sections and huge snowdrifts are piled along the divide ready to break loose without warning.

✦ Two shifts are now employed at the mine of the Mineral Mountain Company in the dry-ore belt district. The crosscut has been advanced 400 ft. and the orebody opened from the 300-ft. station, where the vein is said to be 20 ft. wide and to contain quartz and siderite mixed with gray copper. The crosscut will be advanced another hundred feet as the face will have then reached a point beneath the upper workings where considerable ore was exposed. The company owns a group of patented claims adjoining the Polaris and Chester properties.

✦ Disclosures considered important have been made at the property of the Golconda Lead Company, where the east Mayflower vein has been reached by an 80-ft. crosscut south from the East Mayflower drift. The operations are on the main Golconda tunnel level. The vein showed considerable mineralization, with some high-grade streaks, which encouraged the belief that a drift along this ledge will develop a body of commercial ore.

✦ Installation of the new hoisting and pumping equipment at the Metropolitan mine, on Big Creek, is nearing completion, according to R. S. Merriam, engineer in charge of operations. In addition to the new electric hoist and automatic Ingersoll-Rand 200-station pumping unit, a skip pocket is being built on the tunnel level which will hold around 25 cars, and permit all tramming to be done on the day shift. Only a limited amount of work was completed on the 200 level, as it is planned to first explore the 400 level, with the advantage of having greater depth on the vein. More ore was disclosed on the 200 level than in the tunnel above.

✦ The Coeur d'Alene mines recently entertained 38 mining students from Witwatersrand University, at Johannesburg, South Africa. The young men are in America to visit the leading mining and industrial centers.

✦ Operations at the Pontiac company's property, in the Murray district, will get under way as soon as the snow permits, according to H. C. Stapleton, manager. The work will be to drive a new crosscut tunnel lower than the No. 4, and the new tunnel will be located on Wesp Creek. This work is designed to cut the vein at a point beneath the oreshoot disclosed in the upper levels and will require approximately 1,600 ft. of tunneling.

A MIDSUMMER SCENE in the Lardeau district of British Columbia, where the Teddy Glacier Mining Company is exploiting a small, rich gold deposit through a glacier. The bunk house and other buildings are constructed on the glacier and waste rock is dumped on top of the ice. Airplanes have served this unusual enterprise by dropping several tons of supplies and equipment near the entrance of the tunnel

Philippine Gold Production Sets New Records for the Islands

Output During 1935 Greatly Increased, and Greater Activity Is Anticipated During the Current Year—Gold Placer Mining in Paracale Bay Revived After Many Years—Manganese Deposits Being Developed in Sulu Archipelago

STEADY GROWTH, resulting in a 40 per cent increase in gold production, marked the mining industry of the Philippine Islands in 1935. Unofficial figures, compiled by the *Baguio Bulletin,* mining supplement of the *Manila Daily Bulletin,* show that during 1935 over $16,000,000 in gold was recovered in fourteen plants. The Baguio district, as might be expected, led in this production, over $10,500,000 coming from Benguet and Balatoc alone.

✦ Five new companies put mills in continuous operation during the year—Demonstration, Suyoc Consolidated, United Paracale, I.X.L., and Salacot. Though, of course, the Baguio district was responsible for most of the actual production, much of the mining activity during the year was seen in other areas. Marsman & Company was responsible during 1935 for the revival of the Paracale-Mambulao district. After considerable preliminary work done in 1934 and in the early part of 1935, the Marsman interests constructed a mill in the United Paracale property, and production started in May. At the other end of the same area, work was started in the fall of 1935 on a mill for the San Mauricio Mining Company. Production is expected to start by May or June, 1936.

✦ Placer mining, practically neglected for the last twenty years, was started again in Paracale Bay, where Marsman & Company is operating the Coco Grove Placer Syndicate. Two large dredges have been leased from the Netherlands Harbor Work, and during the past few months a channel from the sea to the town of Paracale has been dredged, and with the dredges thus safeguarded against typhoons, active production was started in January. This area yielded between $8,000,000 and $10,000,000 in gold during early drege operations, and the Marsman engineers have estimated that more than $5,000,000 is yet to be recovered.

✦ Another old district is seeing activity as result of the work of Andres Soriano and his group, all prominent Manila capitalists. This organization owns Antamok Goldfields, third largest producer in the Islands and one of the most promising mines in the Baguio district.

✦ In May, 1935, the Masbate Consolidated Mining Company was organized by the Soriano group, its purpose being the purchase of Panique mine, Colorado mine, and the Boston Hill claims on the island of Masbate. Since 1914 mining has been going on at Panique mines, the total output being over $6,000,000, resulting from the treatment of around one million tons of ore. Masbate Consolidated immediately started an expansion program, by which the old Panique mill, in operation since 1914, has been dismantled and a new cyanide plant built. When completed, this plant will have a capacity of 2,000 tons a day, which will be the largest cyanide operation in the Philippines.

✦ Several other branches of the mining industry have come to public attention during the year. Benguet Consolidated has started production of chromite from the Forani mine, in Camarines Sur, and has developed numerous deposits of chrome at Masinloc, in Zambales. Several other companies have followed Benguet's lead in investigating chrome-ore possibilities. So far, however, only one mine has reached production, that of Forani.

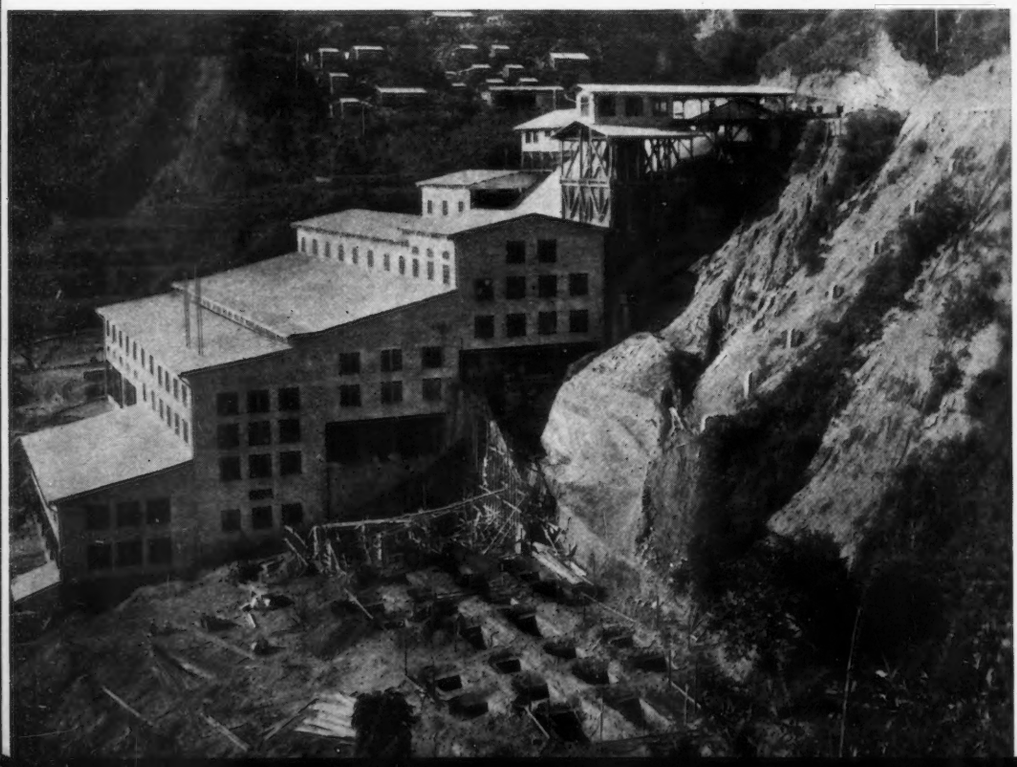
✦ One company, the Philippine Iron Mines, has developed iron-ore deposits in Camarines Norte, and shipped some 300,000 tons of ore to Japan. This amount will probably be doubled in 1936.

✦ At the southern end of the Islands, in the Sulu archipelago, manganese deposits were discovered and are now being developed. Preliminary reports from this region indicate that a considerable quantity of high-grade manganese ore is available. Here again the logical market seems to be Japan.

✦ Prospects for 1936 are good. Several new mills are being constructed, among them the Big Wedge, a 150-ton cyanide plant being built by Atok Gold Mining Company (operating the Big Wedge on a profit-sharing basis), and San Mauricio, a 150-ton flotation-cyanidation plant being built by Marsman & Company (general managers of San Mauricio). Many of the established companies are increasing their capacities. Itogon, now milling around 10,000 tons a month, will be handling 15,000 tons a month in the near future; Suyoc Consolidated is raising its capacity from 5,000 to 6,000 tons a month; United Paracale, now handling 3,600 tons a month, is expected to have a capacity of 10,000 tons a month soon; Antamok Goldfields is contemplating increased mill capacity, as are Demonstration and Baguio Gold.

✦ During the past few months there has been a mild oil boom in the Islands. Some twenty companies were formed to exploit oil lands in the provinces of Tayabas, Samar, Leyte, and Cebu, all south of Manila. Developments in this branch of the industry were considerably upset in December and January by political developments which to date are still unsettled. An investigation was ordered of the various new companies, and President Quezon canceled the

PHILIPPINE GOLD-MINING operations continue to increase. The Antamok Goldfields Company is constructing an addition to the present 400-ton concentrating plant, which is the third largest producer in the Islands, shipping about $120,000 of gold bullion each month



leases of most of the companies. It is expected, however, that the Commonwealth administration will provide for the proper development of the Philippine petroleum resources.

✦ Definite announcements have not been made by Benguet Consolidated and Balatoc as to plans in 1936, but it seems likely that they, too, will continue their program of expansion which has been going steadily on for the past few years. At the present rate of expansion, gold production for 1936 will be between $20,000,000 and $25,000,000. Other branches of the industry will increase in importance during the year but are not expected to be of any great economic importance.

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Greater Exploration Planned For The Ropes Mine

Calumet & Hecla Consolidated Copper Company is building a small crushing plant at its Ropes gold mine property, in the Ishpeming, Mich., district. It will be used to reduce samples of ore taken from the openings. The company is in its second year of prospecting at the Ropes and is drifting in an easterly direction on the bottom level of the shaft. Exploratory work is being given considerable attention at the Ropes. The E. J. Longyear Company has been granted a new contract and has started operating a new drill about 1,500 ft. east of the shaft. The last drilling was done about 6,000 ft. west of the shaft. Additional drilling is being done on the bottom level. A crew of 25 men is being given steady employment at the property. H. Eidemiller, formerly employed by the Oglebay, Norton Company at Ramsay, Mich., has accepted a position as geologist for the Calumet & Hecla company at the Ropes. Additional laboratory facilities will be provided in conjunction with the new crushing plant.

✦ The new shaft being sunk at the Globe property by the Copper Range company is down more than 90 ft. and is within a short distance of the water level. It is a circular drop shaft of reinforced concrete. Severe cold weather impeded progress for a time, but use of electric and steam heat and salt for thawing purposes solved the problem.

✦ Calumet & Hecla also is sinking a shaft at its new exploration at Central, in Keweenaw County, where rich copper values have been opened. The company's Ahmeek mine, recently reopened, is producing, and three stamp heads in the Ahmeek mill are operating.

✦ Creditors and shareholders of the Arcadian Consolidated Mining Company have been notified that a court application has been filed for the dissolution of the company.

Some Mexican Labor Strikes Are Settled as Miners Win Objectives

Mining Companies Attempt to Arbitrate Labor Problems—Tin and Silver Deposit Reported Found Near the Aguascalientes and Zacatecas Border

LABOR TROUBLES continued to hamper the Mexican mining industry in late winter, although there are some improvements in this regard in the form of the settlement of several strikes.

✦ In a full-page advertisement, published in a Guadalajara (Jalisco) newspaper, and addressed to the national authorities, the federal labor officials and those of Jalisco and their workers, the Amparo Mining Company, and the Cia. Minera de "La Piedra Bola," S.A., American enterprises, said in part:

"On Jan. 3, 1935, these companies, acting within the law, asked authorization for a gradual suspension of activities which would become permanent because of the evident and proved exhaustion of ore. A strike started in February, 1935, and was settled under an agreement reached on June 29 which provided resumption of work on July 3. The long suspension of work, and, later, the increased value of silver, lengthened a little the life of the companies' mines, a life which had been estimated both by companies' experts and by those of the labor department at five months, taking as a basis the activity that obtained in December, 1934. Despite the fact that the companies were convinced that resumption of work under the circumstances mentioned would oblige them to operate at a loss if they did not have an increase in efficiency on the part of their workers or if silver values decreased, by good will and a desire to solve conflicts confronting them, they agreed to resume work under those conditions. The same agreement made before the federal labor department contains the acceptance of the Industrial Syndicate of Mining, Metallurgical and Similar Workers of the Mexican Republic, fully authorized by the federal board of conciliation and arbitration, that negotiations for a definite suspension of work would be suspended for only three months and would be resumed in October, 1935. Conferences for submitting proofs and opinions, etc., having been completed, our arrangements were completed on Oct. 10, 1935. Up to now, these companies have not been notified as to the decision of the labor authorities. These companies observe that during the course of their negotiations efforts by leaders of the Syndicate to obstruct by all means within their reach our obtaining that authorization to suspend activities.

"These companies do not criticize the Syndicate's attitude in this regard; on the contrary, they find that attitude perfectly justified in defense of their interests and almost appreciate the good wishes that such attitude demonstrates for the companies to be in conditions, or, at least, that these companies would find any unexpected opportunity to prolong indefinitely their works. . . . The companies, confronted by this situation which has practically become unbearable, have sent a statement to the federal labor authorities advising them of the absolute impossibility of continuing operations under conditions mentioned, especially so if silver prices continue to decrease. Almost ignoring the frequent breeches of discipline in the Hacienda de Beneficio, 'Las Jimenez,' such as the unjustified attitude of the personnel in declaring the superintendent 'non grata' and not allowing him to execute his duties, as well as other equally unjustified actions, and whose final result is loss of efficiency and lost income for the companies, we take the liberty, with all due respect, to let the federal and Jalisco labor authorities know that having exhausted, as we have exhausted, all the resources of good will, of condescendance, and especially those of an economic nature, and there being no solution of this conflict, it will have to end in the inevitable forced suspension to which the matter must come. Furthermore, we let those to whom it may concern know that if these companies obtain the prompt sanction for the gradual and definite suspension of work they have requested, adjusting their personnel to circumstances and the demands of service, they will be able to fulfill one by one all their obligations. . . . As it is impossible for these companies to continue operating at a loss that they are now experiencing, they are compelled, most regretfully, to so advise the federal authorities, the federal labor authorities, the Jalisco authorities, the general public, and especially their workers, so that each of these esteemed elements decide what best suits their interests."

✦ Paul W. Avery and Samual M. Faneuf, mining engineers for the Amaparo Mining Company at Etzatlan, State of Jalisco, were kidnaped by Mexican bandits on Feb. 10, but were reported released upon payment of ransom.

✦ Joaquin de Lara, Zacatecas capitalist, has filed on six claims in the Arroyo del Huancho district, on the Zacatecas and Aguascalientes border, which he says will yield 100 kilograms of tin daily and a considerable amount of silver. He plans intensive operations.

✦ The strike against the Cia. Minera de San Francisco y Anexas, S.A., at its Jeronimo unit, Oaxaca, ended when the company agreed to meet the employees' demands.

✦ Regulations covering temporary imports of copper matte, ores, and mineral products for treatment at plants in Mexico for export have been enacted by the Ministry of Finance.

✦ Golden Girl Mining, the president of which is Alberto Mascareñas, former managing director of the Bank of Mexico, is completing installation of a 50-ton mill at its gold-silver properties near Tepic, Nayarit, where it proposes increased work in March.

The Vojetin Mine Will Be Another Base-Metal Producer in Yugoslavia

Development in Past Five Years Discloses Substantial Tonnage of Lead, Zinc, and Silver Ore Ready for Mining—Trepca Mines Increasing Mill Capacity to Treat Vojetin Ore—New Shaft for Old Roman Gold Mines in Wales

KOPAONIK MINES, LTD., is raising £123,000 of working capital to bring its Vojetin mine, in Yugoslavia, into production. It has had the mine under development for four or five years, funds being supplied at first by Selection Trust, Ltd., and later by this company and Central Mining & Investment and the Union Corporation. These three financing companies, it is understood, will take practically all the shares Kopaonik is issuing. Ore reserves of the Vojetin mine, partly proved and indicated, are estimated at 900,000 tons averaging 9 per cent lead, 6 per cent zinc, and 3.5 oz. of silver per ton. It is understood that there are good prospects of large tonnage developments. A ropeway will be erected to convey the ore from the mine to a point on the railway 23 miles from the Trepca mill, which will treat at first 10,000 tons monthly.

✦ Roman Deep Holdings, reopening the old Roman gold mine at Plumpsaint, Carmarthenshire, Wales, reports that a crosscut at the 260-ft. level has revealed a quartz vein assaying 17.3 dwt. over a width of 32 in. This discovery and other developments of less sensational richness but of very good workable grade have caused the company to decide to sink a new working shaft to the 600-ft. level and proceed with an extensive campaign of exploration. Plans for a power plant and a milling plant are said to be in preparation. A diamond-drilling contract is to be placed.

✦ The Dolcoath mine, which was a famous Cornwall copper producer in the eighteenth century, and from 1799 to 1867 a producer of copper, tin, arsenic, silver, and cobalt, has been purchased by South Crofty, Ltd., for £22,000 cash. South Crofty produced 56 tons of block tin in January and is paying dividends. Despite the handicap of having to pump the considerable flow of water which drains in from adjoining idle mines, South Crofty is getting results which are reviving the interest in the possibilities of Cornish tin production.

✦ Interest in Gold Coast (West Africa) is undergoing a further revival, due to stimulation from recent developments. Ashanti Goldfields Corporation, for instance, has paid 85 per cent in dividends out of last year's earnings, against 75 per cent a year ago. Its net for the year was £955,343 from the treatment of 192,110 tons of ore, or nearly £5 per ton, and was £108,771 higher than in the preceding year. It now has ore reserves of 1,059,224 tons averaging 19.8 dwt., and as its total operating costs have been reduced to 27s. per ton, it has a further profit in sight of approximately £5,000,000. Another Gold Coast company, Bibiani, long considered a more or less doubtful prospect, earned £99,049 last year, and reports ore reserves of 1,706,200 tons averaging 8.3 dwt. per ton (which is an increase of 0.45 dwt.). The company is raising the capital required to increase the size of its reduction plant materially. The Gold Coast seems to have entered upon one of those periods, occasionally noted elsewhere, when all the mines look well, all the developments are encountering better-than-expected values, and the results of all the explorations are gladdening to the hearts of the explorers. Even the workings in the long discredited Banket Reef are disclosing satisfactory values over good widths and long stretches of ground. A considerable expansion of activities is in prospect.

✦ In East Africa better results were obtained by Kimingini Gold in December, 911 oz. being recovered from the treatment of 2,593 tons milled, an average of just over 7 dwt. per ton. Kentan Gold Areas is getting drill cores from depths of 400 to 580 ft. in its Sanza Concession, showing values of 3.9 dwt. over 7 ft. and of 16.9 dwt. over 4 ft. 6 in., the indications so far being large tonnages of medium-grade ore in unusually wide veins. Elsewhere in Tanganyika Territory East African Goldfields is pushing development work into areas where the vein narrows to 3 ft. or thereabout and finding higher values than hitherto. One oreshoot is stated to show an average of 19.8 dwt. over a width of 34 in. for a distance of 140 ft. A concession covering a large alluvial area has been secured in the Lupa region by the Lupa Exploration Syndicate. Kavirondo Gold Mines, Ltd., has just raised £130,000 of working capital for the development and exploration of extensive properties and concessions in Kakamega and other Kenya Colony districts. No relaxation of the interest displayed for three years past in prospecting in East Africa is apparent.

✦ At the British South Africa Company meeting, Sir Edmund Davis said: "The Northern Rhodesia mines can not only easily supply the tonnage (of copper) required by this country (British consumption was about 260,000 long tons last year), but are also able to supply, should there be a market, a large proportion of the outside consumption of the world. That is an object we all have in view, and everything possible should be done to achieve it." The chairman of British South Africa Company said the production costs of the three Northern Rhodesia companies last year, "including everything except depreciation and interest," were, per long ton of copper, as follows: Rhokana, just over £22; Roan Antelope, between £19 and £20; Mufulira, between £27 and £28. These figures are interesting as showing how an investment company having large holdings of the shares computes the costs. The chairman stated that prospecting had been carried on steadily in the several Northern Rhodesia concessions, but that there were no very important results to record.

✦ Northern Rhodesia's copper production was 11,089 long tons in December, against 9,546 in November, and 13,905 in December, 1934. Cobalt production was 416,112 lb., against 157,839 lb. in November.

✦ Roan Antelope reports for the quarter ended with December an operating profit of £197,000, allowances for interest and depreciation reducing this to £137,000, subject only to taxation. As Roan's production quota is 4,200 tons a month, and as the average price of standard copper during the December quarter was £35 4s. 6d., it is computed that the cost per long ton of blister copper was £19 12s. before interest and depreciation, and £24 7s. with these charges included, the latter being the equivalent of about 5.43c. per pound.

✦ Trepca Mines, Ltd., made an operating profit of £120,625, subject to depreciation and taxes, in the December quarter. The ore milled, 148,515 dry metric tons, averaged 8.79 per cent lead, 8.24 per cent zinc, and 2.904 oz. of silver per ton. Revenue per ton of ore was £1 12s. 11d. and working costs, including London expenses, averaged 16s. 3d. per ton. In the deepest level of Trepca's Stantrg mine 6,351 square meters of ore has so far been developed, which averages 9.3 per cent lead, 1.7 per cent zinc, and 4.1 oz. of silver per ton. In January Trepca set up a new milling record, treating 52,868 metric tons of ore. Its output was 5,657 metric tons of 80.02 per cent lead concentrates averaging 26.6 oz. of silver per ton, and 7,156 tons of 50.18 per cent zinc concentrates.

✦ Another unit, the fourth, is to be added to the Trepca mill, work beginning immediately. This will bring its capacity up to 68,000 metric tons of ore per month. An extension is necessitated by Trepca having entered into an agreement to mill approximately 120,000 tons of ore annually for Kopaonik Mines, Ltd., which will soon start production.

PERSONAL ITEMS

Lionel Brooke has removed his consulting office from Sudbury to Toronto.

C. H. E. Stewart, mining engineer, has returned to Vancouver, B. C., after a month's trip to Arizona and Mexico.

Oran M. Anderson is conducting surveys for the Anglo American Mining Corporation at Randsburg, Calif.

Robert Peele, of the School of Mines of Columbia University, has been made an honorary member of the A.I.M.E.

Ward T. Graham, mine superintendent at Baguio Gold, has been promoted to become general superintendent.

G. R. McLaren is in charge of the renewed operations of Goodfish Mining Company north of Kirkland Lake, Ontario.

Ernest William Ellis is making examinations of gold properties in California and doing consulting work for metallurgical plants. His headquarters are at Grass Valley, Calif.

ERNEST WILLIAM ELLIS

D. W. M. Ross has assumed the position of superintendent at the Long Lake property of Lebel Oro Mines, Ltd., in the Sudbury district of Ontario.

Glenville A. Collins, of the Collins Pacific Company, San Francisco, is in Arizona examining properties for Pittsburgh interests.

Selwyn G. Blaylock, vice-president of Consolidated Mining & Smelting Company, of Trail, B. C., has been elected a director of the A.I.M.E.

Ray J. Barber, consulting engineer, of San Francisco, has left for Colombia, S. A., to investigate placer deposits there for American and Colombian clients.

A. G. Ballachey, formerly of the mine staff at Benguet Consolidated, is now at Antamok Goldfields in a similar capacity.

L. K. Jacobsen, mill superintendent at Mount Isa, Queensland, Australia, spent his vacation in Baguio, P. I., during November, 1935.

J. Harold Conner has discontinued his connection with the London Gold Mines Company, Alma, Colo., and is entering the securities field.

Guy E. Diehl, formerly chief mining engineer of the Oliver Iron Mining Company, has been advanced to vice-president in charge of mining engineering and movement of iron ore.

Alden H. Emery, assistant chief engineer of the experiment stations division of the United States Bureau of Mines, has been appointed assistant manager of the American Chemical Society.

W. B. Maxwell, who was for many years general superintendent of the Anyox operations of the Granby Consolidated Company, has been appointed manager of the Beattie mine, Quebec.

John L. Mullin, auditor of the Oliver Iron Mining Company for 30 years, retired the day after he was 70 years old. He is succeeded by **W. J. O'Conner,** who has been assistant auditor.

George L. H. Loram, consulting engineer, of Placerville, Calif., has recently reported on his metallurgical investigations of the VerKamp ore for The Gold Company, Ltd.

Harlowe Hardinge has returned to York, Pa., from an extended trip to San Francisco and Vancouver, B. C., and reports that business activity, in mining machinery particularly, is improving.

R. K. Stockwell has been on a professional trip in southwest China and French Indo-China. He visited the mining districts of Manchuria and Korea during January and February.

Robert Wigglesworth, formerly custom assayer and leaser at Battle Mountain, Nev., has gone to Midas, in the same State, for the Gold & Silver Circle Mines, Inc.

R. S. G. Stokes, for the past eight years consulting engineer to Central Mining & Investment Corporation, Ltd., has been appointed manager of the corporation.

Clinton H. Crane, president of the St. Joseph Lead Company, was on Feb. 19 awarded the William Lawrence Saunders medal of the A.I.M.E., for distinguished service in mining.

S. R. Fox, placer mining engineer, sailed recently from San Francisco to Manila, P. I., to join the staff of Judge Frank B. Ingersoll, who plans to exploit several placers on Luzon Island.

Rensselaer Toll, mining engineer, of Los Angeles, is at Sawyers Bar, California, on consulting work for Norcal Mining Company, Inc., which recently built a 50-ton amalgamating and flotation mill in Eddy's Gulch.

Dr. N. H. Darton recently celebrated the completion of 50 years of service in the United States Geological Survey. His retention in the service after passing the retirement age was ordered by President Roosevelt.

A. J. Keast, manager of Beattie Gold Mines, Ltd., Canada, has been appointed superintendent of Zinc Corporation, Ltd., Broken Hill, N.S.W., in succession to **C. C. Freeman,** who has resigned.

Dr. Stephen Reid Capps, geologist of the United States Geological Survey, delivered the second series of Grant memorial lectures at Northwestern University, Evanston, Ill., on Feb 25, 26, and 27.

J. D. Fraser and **M. R. Arick** have started their new concentrating mill on their tungsten property at Nanyo, about two and a half hours by motor from Seoul, Korea. Their property also contains pockets of molybdenum.

C. L. Hershman has resigned as manager of the Buffalo Ankerite and Marbuan Gold Mines, in the Porcupine camp of northern Ontario, and has accepted a position with the Pardners Mines, operating in Nevada.

Jesse J. MacDonald has arrived in Mexico City after a drive by auto from Los Angeles Calif., a distance of 2,257 miles. He reports good roads all the way and plans to make extensive trips throughout the republic.

GEORGE C. HEIKES

George C. Heikes, mining geologist, has returned to Philadelphia after a recent trip to California, Nevada, Utah, Colorado, and Missouri.

B. D. Harden has resigned as superintendent of the Spanish mine, Washington, Calif., to take a position with a company in the Philippine Islands. **John Bradley** will assume the duties relinquished by Mr. Harden.

Harold H. Johnson has resigned as mine manager of Risks Ltd., Kenya, to accept a similar position with the Tanganyika Concessions, Ltd., at that company's Kilembe Mine, near Fort Portal, Uganda, British East Africa.

Donald D. Smythe arrived in Manila in December last to join the staff of Northern Development & Mining Company. He has had extensive experience in South America, China, and various parts of the United States.

Jules R. Timmins, of Montreal, has been chosen as president of Hollinger Consolidated Gold Mines. He was formerly vice-president. **N. A. Timmins, Jr.** has become a director in the company, filling a vacancy caused by the death of his father, the late Noah A. Timmins.

Stanley A. Meyer is now employed as assistant mine superintendent by the San Francisco Mines of Mexico at San Francisco del Oro, Chihuahua. For the

two years preceding his appointment he was shift boss at the Angangueo, Michoacan unit of A.S.&R.

R. S. Newlin has arrived at the plant of Inspiration Consolidated, at Miami, Ariz., to assume the position left vacant by **C. M. Brinkerhoff,** who was transferred to Mr. Newlin's position as assistant mine superintendent of Andes Copper.

Allan A. Ryan, Jr., has been elected president of the Basin Montana Tunnel Company, replacing **William Hax,** who has retired to devote more time to the management of Jardine Mining Company. Mr. Hax will continue as a director.

George P. Halliwell, formerly assistant professor of metallurgy at Carnegie Institute of Technology, has been appointed director of research at Kramer & Company, Chicago, refiners of non-ferrous metal scrap and producers of brass ingots and non-ferrous alloys.

G. T. Geringer, general superintendent of the Baguio Gold Mining Company for the past few years, has resigned, and is now consulting engineer and director of the Sulu Mining Association, a newly organized company with claims on the Sulu archipelago.

George A. Bell is now mill superintendent at the Demonstration Gold Mines, operating in the Philippines. He was assistant mill superintendent at Benguet Consolidated for some time, and acted as mill superintendent for several months in 1935.

J. W. Still has joined the engineering staff of the New Cornelia branch of Phelps Dodge Corporation. Mr. Still was superintendent of mines for Bagdad for several years. **G. R. Ingham** has resigned as mine superintendent for New Cornelia branch, due to ill health. He had been at Ajo since 1913.

W. G. Donaldson, general superintendent of the Ipo Gold Mining Company in Bulacan Province, P. I., planned to leave his position there on Dec. 31 to join the staff of Consolidated Mines, with headquarters in Manila. Consolidated Mines has extensive chromite deposits in Zambales Province and gold properties in various other parts of the Islands.

R. W. Hughes has been appointed mine superintendent of the Miami Copper Company. Following his graduation from the University of Wisconsin in 1915, Mr. Hughes joined the engineering staff of Inspiration Consolidated Copper at Miami, Ariz. In 1924, he accepted the position of chief mine engineer with Miami Copper, and was advanced to assistant mine superintendent in 1926. **A. P. Jones** has been named as assistant mine superintendent and **D. H. Orr** as chief mine engineer.

OBITUARY

V. T. King, an eminent Chinese geologist, died in Changsa, China, on Jan. 6, following an attack of carbon monoxide poisoning, at the age of 48.

Victor Hon, mining engineer for the Miami Copper Company, died recently as the result of a fall in a chute while working in the 655 level of the mine.

J. Marcellus Snow, mining expert and geologist for the Tintic Standard Mining Company, died recently in Salt Lake City, Utah, at the age of 53.

Rafael Aguirre Cinta, board member for the Cia. Minera de Natividad y Anexas, S. A., who was widely known in Mexican mining and business circles, died at La Lima, Honduras, on Jan. 20.

Sir George Albu, Kimberley and Rand pioneer, and at one time managing director of the Meyer & Charlton properties, died on Jan. 3 at the age of 79.

Judge E. A. Colburn, long identified with the Cripple Creek mining district of Colorado, and at one time sole owner of the famous Ajax mine, died on Jan. 1 at Denver, at the age of 92.

R. H. Van Cleve, mine shift boss at Balatoc, died on Nov. 2 at the Notre Dame hospital, Baguio. He was a member of the class of 1916 of the Minnesota School of Mines, and his home was in St. Paul, Minn.

Christopher Minot Weld, mining engineer, senior member of the firm of Weld & Liddell, of New York City, died in New York on Jan. 9, at the age of 59. Mr. Weld had directed important work in North and South America, Europe, and Asia.

Dr. N. M. Saleeby, director of the medical service of the Benguet Consolidated Mining Company, died in Baguio on Dec. 18 last, following a cerebral hemorrhage. He was 65 years of age. For the past five years he had been identified with the mining industry in the Baguio district.

Edward W. Keith, a prominent and well-known mining engineer, died suddenly of heart failure in Denver, Colo., on Feb. 6, 1936. He was born in Grosse Ile, Mich., on Dec. 27, 1869. Mr. Keith was identified with many large developments in mining and milling in Colorado and for many years was connected with the American Smelting & Refining Company at Leadville, Colo., and afterwards for many years with the Empire Zinc Company of Denver, a subsidiary of the New Jersey Zinc Company. He had a wide experience in the larger mining districts of Leadville, Cripple Creek and the San Juan districts of Colorado. His brother Charles Keith lost his life in a mine accident in Cripple Creek several years ago. Recently Mr. Keith's principal interest was the erection of a large 600-ton capacity mill at Cripple Creek, Colo., on the Stratton estate, for treating the ores from the properties of the Stratton estate, the mill being the last word in the milling of the ores of that district. "Ted" Keith, as he was familiarly known among his friends, was a familiar figure in the mining circles of Colorado and the West. Mr. Keith was the son of a pioneer family of Michigan. His father was Edward L. and his mother Julia H. Keith, of Grosse Ile, Mich. Surviving him are his wife, Eleanor A., his son, Charles A., and his daughter, Jane Keith.

Edward M. Hamilton

An Appreciation

Despite a retiring disposition and an intense application to his work in hand, Edward M. Hamilton, who died on Feb. 12, 1936, at Sacramento, Calif., was widely known in the metallurgical and mining fraternity. His background of metallurgical experience in gold and silver was acquired from a lifetime spent in the field and from consistent research.

Mr. Hamilton was a graduate of Oxford, where he studied for the ministry. From England he went to South Africa at a time when the cyanide process was attracting attention. He played an important part in developing the practical application of this widely used process. He constructed and operated one of the first slime plants, but lost all the money he had invested out of his savings due to the shutting down of the mine. He was instrumental in perfecting a method of collecting sand, which is known as the Hamilton Collecting Tank. Only last year he replaced this method at the old plant of the Minas del Tajo, Sinaloa, Mexico, with more modern methods. Charles Butters' success at Nipissing was said to have been due in part to Hamilton's efforts. In San Salvador he developed the method of precipitating cyanide solutions by the use of aluminum dust.

In South Africa, Mr. Hamilton was cyanide superintendent for Van Ryn Gold Mining Company from 1898 to 1900, and later for the Ginsberg Gold Mining Company, Johannesburg. From 1900 to 1902 he held the position of metallurgical engineer with the Minas Prietas Reduction Syndicate, Sonora, Mexico. Following this he joined the staff of Charles Butters & Company, Ltd., in Mexico, as metallurgist, which position he held until joining the Mines Company of America in 1912.

Many contributions were made to the technical publications by Mr. Hamilton. His analytical mind solved many intricate problems and made him an efficient consultant. Although others patented the method of mixing carbonaceous slimes with vegetable-animal oils as a preliminary to successful gold and silver extraction by cyanide solutions, Mr. Hamilton discovered water-soluble reagents that would effect the same result. His book on cyanide practice published in 1920 is one of the most useful that has appeared, and has played an important part in the application of the cyanide process in the world's gold and silver mining districts.

In 1915, Mr. Hamilton associated himself with F. A. Beauchamp and S. E. Woodworth in the firm of Hamilton, Beauchamp & Woodworth, and this firm established a laboratory in San Francisco with a consulting practice that became widespread. Later the company constructed a custom cyanide plant near Jackson and handled tailings and concentrates, which business continues.

Mr. Hamilton was a member of the American Institute of Mining and Metallurgical Engineers, and at other times held membership in the South African and London mining societies. His wide circle of appreciative friends will deplore his death but cherish the memory of a kind and hard-working friend.

GEORGE J. YOUNG.

LETTERS

Caustic Starch Improves Settlement of Slime

The Editor:

Your readers may be interested in our experience at Dome Mines with a cheap reagent added in minute quantities to the mill pulp to improve both the settlement of slime and clarification of the solution going to precipitation.

Soon after starting the pre-aëration with lime, to which we subject our pulp before cyaniding, difficulty arose in maintaining good precipitation in the presses after about three days' run. As there was a rise in the silica content of the gold precipitate, we suspected silica in solution passing the clarifier leaves and being deposited on the zinc. This might occur by the action of zinc either as a precipitant of silica from the solution or as a coagulant of dispersed silica gel. When the reagent referred to is used, the silica is coagulated before it reaches the precipitation press, as shown by the increased deposit on the surface of the clarifier leaves.

The reagent is a compound of starch and caustic soda. By its use at Dome at the rate of 16 lb. of starch and 8 lb. of caustic soda per day for 1,500 tons crushed, slime settlement has appreciably improved and precipitation will run for ten or fifteen days.

The caustic starch is prepared as follows: To 40 parts of water kept boiling in a drum or suitable tank by means of live steam, there is slowly added one part of starch made into a slurry with four parts of cold water. The mixture is then boiled for 10 min., after which is added one-half part of caustic soda dissolved in water. After boiling for 10 min. more the material can be diluted to a consistency suitable for accurate metering in required quantity to the pulp stream entering the thickeners.

The reagent should be used sparingly at first, for in some cases increased flocculation of the pulp in the classifiers might adversely affect concentration, especially where very fine grinding is demanded.

Use of the reagent at Dome is based on information sent to me by the London office of Consolidated Goldfields of South Africa, Ltd., which found caustic starch very effective in hastening settlement in the company's experimental work on the very slow-settling (oxidized) ores of the Gold Coast Colony. Canadian mines other than Dome have started to use the reagent with good results.

C. W. Dowsett.

South Porcupine,
Ont., Canada.

Tin Concentration in Siam

The Editor:

May I crave your courtesy to correct an error?

On p. 42 of your issue of January, 1936, under the heading of "A New Tin Producer in Siam," a statement is made that the flowsheet is the combined work of R. S. Handy and Holloway & Company, of London. This is incorrect. The metallurgical investigation of Pinyok ore, which resulted in both the new process mentioned in your article and the gravity treatment temporarily adopted, was carried out by men and under my direction in London laboratories hired by Siamese Tin Mines, Ltd., or its forerunners. The flowsheet is based on a principle not hitherto commercially applied to the gravity concentration of tin. This principle was developed independently of either Mr. Handy or G. T. Holloway & Company. It was applied in the testing of a ton lot of ore in the works of G. T. Holloway & Company under my direction after that company had already tested a similar lot by ordinary methods. The improvement was striking, and American interests in the company insisted in sending Mr. Handy to England to satisfy himself regarding the large-scale arrangements.

As shown in your columns, the final flowsheet is a slight modification of that agreed on in conference between Mr. Wagner, of G. T. Holloway & Company, Mr. Handy, and myself.

I have no desire to minimize the sound part played by either Mr. Handy or Mr. Wagner. I have great respect for both these gentlemen, and am sorry that vital omission on the part of your correspondent has made it necessary to write this letter.

C. A. Wood.

16 Victoria Road,
Buckhurst Hill,
Essex, England.

Large Diesel Plant At G.M.B. Tin Mine

The Editor:

In your issue for July, 1935, there is a picture with the caption "World's largest installation of diesel engines used for mining operations at the Balatoc Mining Company near Baguio, Philippine Islands. There are six 625-hp. diesels totaling 3,750 hp. and 2,500 kw."

In view of the above, the following extract from an aritcle by Gordon Burt, A.M.I.A.E., entitled "Notes on the G.M.B. Tin Company in Billiton," is of interest. ". . . at Manggar . . . there is a magnificent diesel electric central power station equipped with the following machinery: Five 6-cylinder, 1,200-hp., 4-cycle, 150-r.p.m. Werkspoor diesels; one 4-cylinder, 1,500-hp., 2-cycle, 150-r.p.m. scavenge air-blast injection Sulzer diesel; four 6-cylinder, 2,100-hp., 2-cycle, 150-r.p.m. scavenge air-blast injection Sulzer diesels; one small diesel electric d.c. generating set, all representing an aggregate of 16,000 hp. in one station." The article referred to is published in Bulletin No. 23 of the Dredging Association Southern Malaya and might interest many of your readers.

G. H. Fairmaid.

Sungei Lembing,
Pahang,
Federated Malay States.

Itogon Filtration Costs

The Editor:

In the January, 1936, issue of *E.&M.J.* an article by Ralph Keeler provides interesting details of practice in the cyanide plant at the Itogon property, near Baguio, in the Philippines. Itogon ore is described therein as "ideal for cyaniding. Part of the gold is associated with pyrite, but most of it is free and very finely divided. The part associated with pyrite is easily made accessible to cyanide solutions by fairly fine grinding. At present the ore is ground to about 65 per cent minus 200 mesh."

From this, it may be inferred that the treatment and extractive methods need not require prolonged contact to get high recovery.

Among the details of cost and operating data, Itogon filter results are listed as follows:

	Per Ton
Operating cost (one stage)	$0.08
Soluble loss	0.05
Total charge against operations	$0.13

Some of the tabulated data in Mr. Keeler's article indicate still higher soluble loss-value than the $0.05 which is used here.

The use of the intermittent Moore vacuum-leaf filter in cyanidation of gold ore seems anachronistic in the light of current results in gold cyanide plants elsewhere. In the better known Canadian gold cyanide plants, typical results from slime filtration by continuous Oliver filters may be cited as follows:

	Per Ton
Operating cost (one stage)	$0.04 to 0.05
Soluble loss	0.01 to 0.015
Total charge against operations	$0.05 to 0.065

There are even lower operating costs on record. A comparison of the two total charges against plant operations shows a very important differential favoring the latter type of equipment.

Over and above this item is the matter of extraction effected in filtration. Detention of slime-pulp in the continuous type filter is only four to six minutes per stage of filtration, and during this time it is a frequent experience in Canadian cyanide plants to find a reduction in the assay value of the washed residues after each stage of filtration which is equal to, or greater than, the operating cost. This additional extraction in the cases cited is obtained from pulp that has been subjected to prior treatment by the usual methods, and is warrant for the multiple-stage filtration which is handling some 13,000 to 14,000 tons daily on continuous filters in the Porcupine and Kirkland Lake areas, and lesser tonnages in the smaller Canadian gold-mining areas.

Donald F. Irvin.

Bronxville, N. Y.

NEW BOOKS

The World's Copper

COPPER RESOURCES OF THE WORLD. *Two Volumes. Published by the Sixteenth International Geological Congress. Pages, total, 855. For sale by the General Secretary, Sixteenth International Geological Congress, care of United States Geological Survey, Washington, D. C. Price to members, $5 per volume or $9 for the set; to non-members, $6 and $10, respectively, postpaid.*

These welcome and informative volumes, which have been prepared by a group of geologists that includes many distinguished men in this country and abroad, constitute one of the products of the International Geological Congress that was held in Washington in 1933. The primary objective of the congress in undertaking this task was to outline the geologic environment of the known copper deposits of the world. In carrying out the work, however, attention has also been paid to the history of the industry's development, the financial and economic factors involved, and the estimation of reserves, so as to demonstrate the economic and cultural bearing of the copper resources. Much of material has been contributed by official Government agencies, and, wherever obtainable, by geologists personally familiar with the districts covered.

Economic Security

SOCIAL SECURITY IN THE UNITED STATES. *By Paul H. Douglas. Whittlesey House, McGraw-Hill Book Company, Inc. Pp. 384. Price $3.*

The history of the attempts to achieve the enactment of legislation to assure social and economic security in the United States is admirably recorded in this volume, which presents, also, the various plans proposed for the attainment of the objective stated and those adopted into law. Mr. Douglas, who is professor of economics at the University of Chicago, has long been a proponent of reforms essential to the beneficent consummation of social and humanitarian ideals. He has written extensively on the subjects which he discusses, and his conclusions bear the imprint of factual information and authoritative interpretation. In this presentation he sets forth in logical order the record of the nation's progress toward the goal of pensions for the aged, unemployment insurance, and other features of social and industrial security. Problems of administration are discussed in detail, as are private pension plans and State and corporation participation—or non-participation—in social welfare projects. The constitutional aspects of the movement are considered, and an appendix reproduces the text of the Federal Social Security Act. The work makes available an extensive array of facts indispensable to clear thinking on, and reasoned conclusions respecting, the vital problems that constitute its subject matter, and it should prove useful in the working library of all concerned with so-called social legislation and with the administration of existing statutes which seek to effectuate the current widespread social and political concern for the aged, the sick, the unemployed—and the unemployables.

Mines of the Antipodes

MINING HANDBOOK OF AUSTRALIA, 1936. *Tait Publishing Company, Melbourne and Sydney, Australia; represented also by The Australian Trade Press Agency, 77 Queen Victoria St., London, England. Pp. 480. Price 20s.*

The principal section of the book is devoted to a summary of the essential information relating to more than 800 gold and base-metal mining companies operating in Australia, New Guinea, Papua, Fiji, Malaya, and New Zealand. This information is unusually complete, and includes capital, directors, secretary, solicitors, bankers, etc., as well as brief details of the mine, ore reserves, and treatment plants as of Nov. 1, 1935. Complete statistics of metal production in all states of the Commonwealth for the past 25 years and the detailed metal and mineral production in each state for 1933 and 1934 comprise an important feature. A summary of the mining laws of the Commonwealth and of Fiji and New Guinea is published for the first time. Other features include London metal prices for the past 25 years, wages awards, glossary of technical terms, a discussion on the valuation of gold-mining shares, and cost data for the mining industry.

Dominion Mining

CANADIAN MINES HANDBOOK—1936. *Northern Miner Press, Ltd., Toronto, Canada. Pp. 367. Price $1.*

This comprehensive review of Canadian mining activities from coast to coast is somewhat larger than any previous edition. It covers a total of 3,774 operations. Some 350 of the companies and syndicates treated are newly formed, and in addition a number of companies formerly listed as inactive are covered in greater detail than previously by reason of resumption of operations.

The Handbook, as usual, analyzes the leading mining companies in great detail, giving directors and operating officials, executive and mine office addresses, property location, development, ore reserves, production, earnings, dividends, financial position, and other important facts. It lists 2,734 inactive reorganized or defunct corporations and is, therefore, especially useful to those who wish to trace ventures which have passed out of current knowledge. Where reorganizations have taken place, the share exchange basis is given whenever possible.

The book carries a seven-year high-low range of stock-exchange quotations and other data such as commission rates on leading markets and federal and provincial transfer-tax rates.

PUBLICATIONS RECEIVED

Gold Mining in South Africa. An address by Hans Pirow. Witwatersrand University Press. Johannesburg, South Africa. Pp. 21.

Mining Laws of Mexico, including a table for computing the tax on silver. In English. Published by the Mineral Survey, Mexico City, Mexico. Pp. 182.

Minerals d'Or de l'Urega Oriental, Kivu, Congo Belge. (Gold Deposits of the Kivu District, Belgian Congo). By Réne van Aubel. Bulletin of the Geologic Society of France. Pp. 675 to 696, inclusive, with three plates.

Southern Musoma Goldfield. Geological map, 25x13 in.. Also a geological map, 28½x20¼ in., of Eastern Musoma Goldfield. Geological Survey of Tanganyika Territory, Dar es Salaam.

Jakob Johannes Sederholm: Biographic Notes and Bibliography. By Victor Hackman. Bulletin No. 112. Geological Commission of Finland, Helsingfors. Pp. 34.

l' Industrie Minière de l' Indochine en 1934. By Guillaumat. Published at Hanoi, French Indo-China. Pp. 92.

The Resistance of Mine Timbers to the Flow of Air as Determined by Models. Cloyde M. Smith, University of Illinois Bulletin No. 279, Engineering Experiment Station, Urbana, Ill. Pp. 64. Price 65c.

Sevriges Officiella Statistik, Berghantering, Berattelse For Ar 1934. By Kommerskollegium, Stockholm, Sweden. Pp. 63.

The Underground Geology of the Tonopah Mining District, Nevada. University of Nevada Bulletin No. 5, by Thomas B. Nolan, Reno, Nev. Pp. 49. Price $1.

Geology of the Tonsina District, Alaska. By Fred H. Moffit. Bulletin 866, U. S. Geological Survey. Pages, 48. Price, 40c.

Coal and Coal Products. A List of Books and Other Sources of Information Regarding. Compiled by F. R. Wadleigh. Published by National Coal Association, Southern Building, Washington, D. C. Pp. 63. Price $1.

EQUIPMENT NEWS

COLLECTING DUST FROM ROCK DRILLS

DESIGNED to meet the demand for a device that will eliminate the hazard of fine rock dust in drilling operations, the Markley Dust Control System has been developed by James H. Markley, New York contractor. Portable units are designed to service from two to four drills. Larger units are available for more extensive operations. By means of a vacuum, dust is conveyed from the drill hole to containers from which it can be carefully removed without contaminating the air in which the operator is working.

The principal parts of a Markley unit are (1) a hood surrounding the drill steel and covering the hole, (2) a primary settling tank in which coarse dust in trapped, (3) a secondary tank containing bag filters for catching fine dust, and (4) a rotary blower powered by a gas engine or air motor which provides the vacuum to draw the dust from the drill into the container. All parts of the unit are connected by 1½-in. hose.

The hood is so designed that it can be attached to, or detached from, the drill without removing the steel from the hole. The primary tank, which catches from 98 to 99 per cent of the drill dust, is a steel cylinder with detachable top and bottom, into which is fitted a strong pasteboard container that can be removed with its dust content. A secondary tank contains bag filters that can be shaken free of dust at desired intervals by means of an external shaker bar. The blower unit is mounted on skids to which a wheel can be attached, and the whole moved like a wheelbarrow. The blower creates a vacuum of about 4½-in. of mercury and discharges from 150 to 200 cu. ft. of air at 1-lb. pressure.

Utilizing Waste Heat

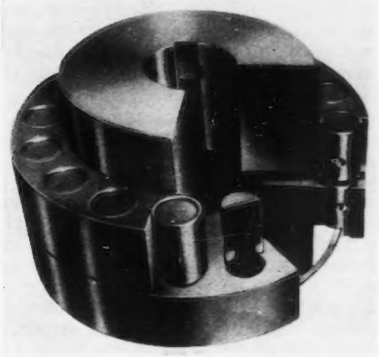
A modernized non-deaërating type stationary feedwater heater that is said to pay for itself in less than one year is announced by Worthington Pump & Machinery Corporation of Harrison, N. J. This heater is for use wherever exhaust steam is available for heating boiler feedwater.

The features of this heater are: A Worthington patented interchangeable pan system which provides a definite and unchanging flow of water in jets and drops, exposing maximum surface to the steam. Water is heated to within 2 deg. F. of the saturated-steam temperature within the heater. Scaling is said to have no effect, hence high efficiency is maintained indefinitely. Multi-baffle separators assure oil-free feedwater. A two-pass filter removes all suspended solid matter. The one-piece cast-iron body, rectangular in form, will operate under 15-lb. working pressure. Pump suction openings are provided on two sides of the heater for convenience of piping hook-up. An improved non-collapsible ball-float trap takes care of overflow, and the proper water level is maintained by an open bucket float of special type.

•

Improved Flexible Coupling

Changes in the design and materials of the Francke Flexible Coupling are announced by the John Waldron Corporation, of New Brunswick, N. J. The changes have been made to meet the changed operating conditions which have occurred in the field of mechanical power transmission within the past few years. All Francke Coupling flanges except the larger sizes are now being made of a forged high-manganese alloy steel. The larger sizes are molded of high-grade semi-steel. In order to prolong the life of the moving parts of the coupling, self-lubricating, wax-impregnated bronze bushings now replace the old-style dry bushings. The new bushings have highly polished bearing surfaces, which provide a large contact area. Due to their self-lubricating feature, little resistance is offered to the end-wise movement of the shafts of the connected machines when under load.



Another improvement is in the design of the cross pins by which the crucible-spring steel laminations are held within the keepers. The center portion of the cross pins which passes through the perforation in the laminations is now made glass-hard. By a special process the ends of the cross pins are expanded into the tapered recesses of the keepers, thereby making it impossible for them to become loose.

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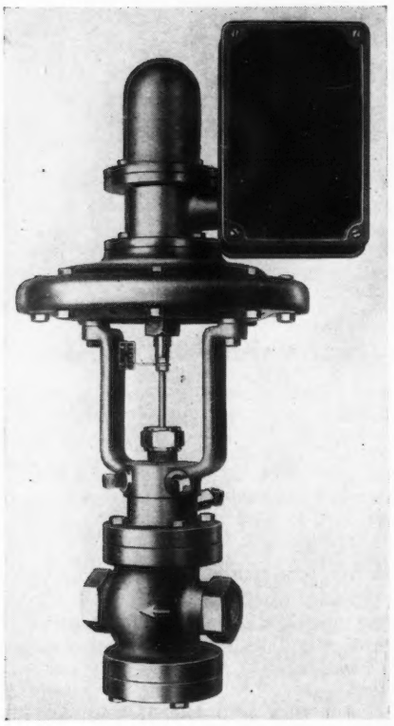
Vernier Valvactor

A new accessory for air-operated control valves, the Vernier Valvactor, developed to eliminate valve sticking and to assure hair-line valve positioning, is the latest addition to the line of control instruments manufactured and sold by The Foxboro Company, of Foxboro, Mass. This device is said to enable throttling type air-operated control instruments to make small gradual adjustments of the



control valve position regardless of friction or hysteresis. It is claimed that the air from the control intrument need change as little as $\frac{1}{2}$ in. of water to cause a corrective positioning of the valve and force the stem to take a position within 1/1000th in. of the previous one.

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Surface Illuminator

An improved method for illuminating opaque or translucent specimens when examining at low magnifications is announced by Bausch & Lomb, of Rochester, N. Y. The illuminator is said to supply a well-balanced annular cone of uniform light, which can be varied in

both intensity and incident angle. It also reveals a maximum of detail in objects with irregular surfaces, thus overcoming difficulties encountered in ordinary above-stage illumination. This improved device may be used with any conventional monocular laboratory microscope whose body tube diameter is 35 or 39 mm. It consists of an annular ring holding six bulbs spaced equidistant around the inside of the ring with individual reflecting surfaces back of each bulb. The ring slips on over the microscope objective and is held in position by an extension rod suspended from a clamp attached to the eyepiece adapter, which may be either vertical or inclined. The surface illuminator can be used only with 48 mm., 32 mm., and 16 mm. microscope objectives. The small bulbs are 2.5 volt, 0.3 amp., and may be secured in either clear or daylight glass.

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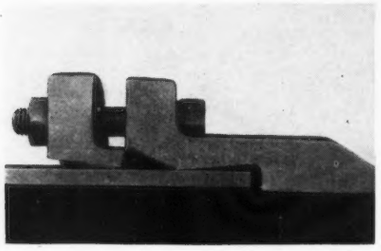
Cast-Iron Joints

The United States Pipe & Foundry Company, of Burlington, N. J., announces the U. S. joint for use in gas, water, and steam service. The pipe joint may be assembled with a wrench, and is said to need no caulking or compounds for securing joints. Accessories consist of follower ring, gaskets,



and bolts, all of which are interchangeable. Some of the advantages reported for this type of joint are deflection without leakage, ease of assembly, tightness under pressure of gas or water, resistance to corrosion, and connection to plain and existing pipe line without use of an adaptor. Asbestos may be supplied if desired for high-temperature service.

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Heavy-Duty Welder

A newly improved line of heavy-duty arc welders is announced by the Harnischfeger Corporation, of Milwaukee. The most important changes and refinements are said to include the new oversize, two-bearing armature shaft, removable ball-bearing capsules; more simplified single-current control; dust-proof calibration plate; heavy-duty built-in polarity switch; and drip-proof housings.

The new 200-amp. machine retains the previous P&H-Hansen generator design with the patented internal stabilizer coils embedded in the main pole tips, unique short-circuit winding, and magnetic bridge, which broaden the welding range and improve the uniformity of current.

Motors have solid cast frames with top opening for terminal leads and mounting of the magnetic switch-type protection; and are operated by push-buttons. A constant flow of cooling air, circulated by the large aluminum fan between motor and generator, is discharged at the end of the all-welded generator housing. Connections are available for standard or special voltages of 2- to 3-phase, 60 and 50 cycles. Gasoline-powered units in a wide variety of stationary and portable mountings also are included in the new line. A transformer with variable resistance and switch for 110 volt and 50- or 60-cycle a.c. only is supplied with the illuminator and provides a means for dimming the light to any degree of intensity.

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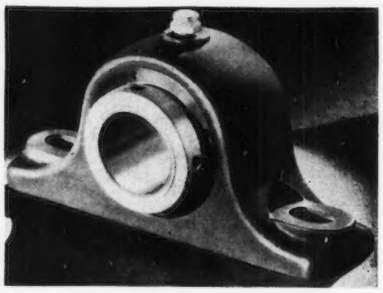
Self-Aligning Bearings

Announcement is made by Link-Belt Company, 910 S. Michigan Ave., Chicago, Ill., that it has developed a new line of bearing units, which are known as Link-



Belt Shafer Self-Aligning Roller Bearing "Series 400." These units are available for pillow blocks, flange bearings, hangers, and take-ups.

The advantages of the new combination are said to be the inherent self-alignment, the ability to carry radial loads, thrust loads, and radial and thrust loads combined.

Self-alignment of the Shafer roller bearings is provided by concave rollers between convex outer races and a spherical inner race on the sleeve, which is free to deflect with a shaft temporarily misaligned or out of line because of inaccuracies of installation. The rollers travel in a true path on accurate races. Labyrinth seals protect the bearings, and bores are ground for direct shaft application. The "400 Series" self-aligning roller-bearing units are for shaft sizes from $\frac{3}{4}$ in. to 3 in. in diameter.

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Gritty Liquids Pump

Open-impeller non-clogging centrifugal pumps for handling solid materials in suspension, gritty liquids, and liquids containing stringy material are now being made in a wide range of sizes by the Worthington Pump & Machinery Corporation, Harrison, N. J. The pumps are of rigid "Monobloc" construction, and are said to be convenient, dependable and compact, and the greatest overall length of the largest size is 23 in.

The shaft, of large size; extra-heavy-duty grease-lubricated ball bearings; rugged casings; a stuffing box of ample depth arranged for water or independent seal; water thrower ring; splash-proof motor; fan for air circulation; and protecting apron on motor—characterize these units.

•

Protecting Metal Surfaces

Two new methods of preparing metallic surfaces against the ravages of wear and corrosion economically by the use of metallic boron crystals are announced by Colmonoy, Inc., of Los Nietos, Calif.

One method, known as "sweat-on," is to mix the metallic boron crystals with

sodium silicate (water glass) to form a stiff paste; then cover the surface to be processed to the desired thickness (normally from one-sixteenth to one-eighth inch) and apply sufficient heat from an oxy-acetylene torch, carbon arc, or atomic hydrogen torch, to sink the crystals into the parent metal. It is said this method produces a relatively level surface that is impregnated with diamond-hard, non-oxidizing corrosion-resistant crystals which retain their identity and do not fuse into a solid mass.

The other method is the "cast-on" process, which is used where it is necessary to have a very smooth or ground and polished surface. In this process these same metallic boron crystals are held in a matrix of nickel alloy, which has a lower melting point than steel, therefore facilitating easy melting and pouring to fill any desired space between a copper or cast-iron mold and the metal to be processed.

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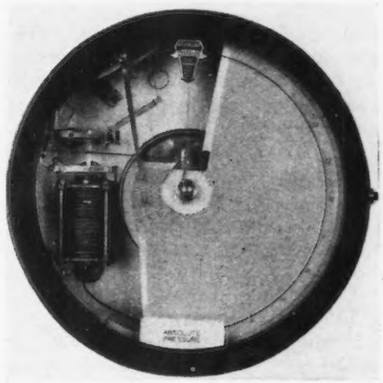
Absolute Pressure Gage

The Foxboro Company, Foxboro, Mass., announces the development of a new gage to measure absolute pressure. This instrument is said to have a unique method of compensating for changes in barometric pressure that assures correct readings at all times. The pressure-measuring and barometric compensation units are mounted together, forming a complete, rugged, and integral actuating movement. Two hydrons, one measuring direct pressure and the other barometric pressure, are so connected that their pressures directly oppose each other. The compensating hydron, which is sealed under full vacuum, exactly counterbalances the barometric effect on the main pressure hydron, and thus enables that hydron to measure only true absolute pressure. This method of measuring absolute pressure is comparable with the manometer method of measuring differential pressure, whereas previous methods could be likened to the method of using two pressure gages for the same purpose. In the latter case a small error in either of the pressure readings amounts to a large percentage of the difference.



New design has enabled this company to do away with all unnecessary linkage from the actuating movement.

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BULLETINS

Phenol Fiber. Continental-Diamond Fibre Co., Newark, Del. Manufacture and use of synthetic resinous material in industry. Pp. 46.

Optical Aids. Bausch & Lomb Optical Co., Rochester, N. Y. A booklet of instruments useful in the metal-working industry. Pp. 14.

Anti-Freeze Tanner Gas. Sullivan Machinery Co., 1600-C Bell Bldg., Chicago, Ill. A circular describing an anti-freeze system for air lines.

Hoists. Sullivan Machinery Co., 1600-A, Bell Bldg., Chicago, Ill. Bulletin 76-X. Hoists for construction, timbering mines, and general use. Pp. 12.

Slushing Hoists. Sullivan Machinery Co., 1600-B, Bell Bldg., Chicago, Ill. Used for ore moving, rock tunnel loading, and surface scraping. Bulletin 76-Y. Pp. 12.

Explosive Service Bulletin. E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. Chart of explosives and uses to which they are adapted. Pp. 3.

Sand Pumps. Allen-Sherman-Hoff Co., Lewis Tower, Philadelphia, Pa. Pumps lined with rubber parts resisting abrasion and acids. Pp. 23.

Rock Hammers. Worthington Pump & Machinery Corp., Harrison, N. J. For light boulder popping to heavy blast-hole drilling. Folder No. W-1200-B-16. Pp. 3.

Portable Electric Tools. Skilsaw Inc. 3310-20 Elston Ave., Chicago, Ill. General catalog No. 36, illustrating electrically driven tools for maintenance and production operations. Pp. 33.

Duplex Piston Pumps. Worthington Pump & Machinery Corp. General Service Pumps. Folder W-102-B-1. Pp. 4.

Wire Cloth. Audubon Wire Cloth Corp., Castor Ave. and Richmond St., Philadelphia, Po. Illustrated Catalog No. 40 of mesh wire cloth, space wire cloth, and flexible wire cloth. Pp. 55.

Agitator and Mixer Book. The Patterson Foundry & Machine Co., East Liverpool, Ohio. Catalog of agitator and mixing equipment. No. 355. Pp. 52.

Boiler Plant Equipment. Combustion Engineering Co., 200 Madison Ave., New York. Boiler types, steam generating units, stokers, and heat-recovery equipment. Pp. 4.

Air-Cooled Compressors. Chicago Pneumatic Tool Co. Specifications of various units. Bulletin 759. Pp. 11.

Combined Engine and Compressor. Cooper Bessemer Corp., Grove City, Pa. Starting units. Pp. 4.

Welding Equipment. Harnischfeger Corp., Milwaukee, Wis. 1936 Bulletin No. HW4. Condensed specifications and performance data of various welding units. Pp. 23.

Centrifugal Pumps. Worthington Pump & Machinery Corp., Harrison, N. J. Open impeller pumps for liquids containing solid, gritty, or stringy material. Folder W-321-B-7. Pp. 3.

Carbon Monoxide Indicator. Mine Safety Appliance Co., Pittsburgh, Pa. Folder illustrating a portable instrument designed to indicate low concentrations of carbon monoxide in air. Pp. 2.

Conduits. Crouse-Hinds Co., Syracuse, N. Y. Completely indexed and illustrated catalog of conduits. No. 2500.

Compressors. Worthington Pump & Machinery Corp., Harrison, N. J. Single, horizontal, single-stage steam and motor driven, 11- and 13-in. stroke. Bulletin L-611-B-4A. Pp. 5.

Dredging Pumps. Lawrence Machine & Pump Corp., 371 Market St., Lawrence, Mass. Pumps for general dredging service. Bulletin 208. Pp. 4.

Term-Payment Purchase Plan. Worthington Pump & Machinery Corp., Harrison, N. J. A folder dealing with a term-payment purchase plan which has been developed by this corporation to enable purchasers of its products to take advantage of the provisions of the National Housing Act as amended for industry. Folder W.P. 1088.

Cast-Iron Machinery Repair. Linde Air Products Co., 205 East 42d St., New York, N. Y. Repair of cast-iron machinery by oxy-acetylene process. Pp. 8.

INDUSTRIAL NOTES

• Universal Dredge Manufacturing Company, 810 14th St., Denver, Colo., announces a line of dragline floating-type placer dredges with capacities from 1,000 to 6,000 cu.yd. per day. The company also manufactures bucket-ladder dredges and crawler-mounted, dry-land placer machines.

• The Yuba Manufacturing Company, of San Francisco, Calif., and Lobnitz & Company, Ltd., Renfrew, Scotland, have recently combined their dredge activities for all territory outside of the United States' possessions, Canada, and Yukon Territory into a company known as the Alluvial Dredges, Ltd., with headquarters at 55-61 Moorgate, London, E.C. 2, England.

• Announcement is made by the Harnischfeger Corporation, of Milwaukee, of the appointment of R. L. Mead as manager of the corporation's Chicago office at 20 North Wacker Drive.

• The Torrington Company, Torrington, Conn., and its subsidiary, The Bantam Ball Bearing Company, South Bend, Ind., announce the appointment of A. S. Hellstrom as manager of the Cleveland, Youngstown, Akron, and Wheeling districts, with offices in the Caxton Building, Cleveland, Ohio.

• The "Achema VIII" exhibition of chemical plant, organized by the Dechema Deutsche Gesellschaft für chemisches Apparatewesen E.V. (German Chemical Plant Association), will be held in Frankfurt on the Main early in September, 1937, together with the 50th general meeting of the Verein Deutscher Chemiker. Frankfurt on the Main is not only suitable by reason of its geographical and economic position, but also because the Verein Deutscher Chemiker was founded there in 1887.

• General Refractories Company announces the appointment of The Bird-Archer Company, Philadelphia, Pa., as dealer agents of refractories in the Philadelphia area.

• The agreement made between Safety Mining Company and the Sullivan Machinery Company whereby Sullivan was licensed to develop Airdox has been modified by mutual agreement. After Jan. 1, 1936, the future development and marketing of Airdox will again be handled by Safety Mining Company.

• The Denver Metal & Machinery Company has acquired all rights and equipment of the Railway & Mining Supply Company, of Denver. This new arrangement is said to give the company a large amount of new and used machinery. The Denver Metal & Machinery Company is now managed by Max Grimes and J. T. McShane.

• J. P. Bonardi, General Motors Building, 1775 Broadway, has been appointed sales representative in New York City for E. J. Longyear Company, the mining engineers and diamond-drill contractors.

• The 1936 National Metal Congress and Exposition, to be held in Cleveland's Public Auditorium, will be held from Oct. 19 to 23, inclusive.

SUMMARY OF

MONTHLY COMMENT . . . DAILY AND AVERAGE MONTHLY

THOUGH industrial operations during February were on a lower plane than in the first month of the year, owing partly to cold weather conditions over a wide area of the country, buying of major non-ferrous metals increased. The tone was firmer, both lead and zinc advancing moderately toward the close on a substantial revival in demand. "Asking" prices for copper were raised by two important producers—Phelps Dodge and Anaconda—which caused excitement to run high shortly before the TVA decision was rendered by the Supreme Court. Offerings of copper at the old quotation continued in volume from other sources.

Much was expected in metal circles of the TVA decision. The ruling was limited in scope, the Court upholding the Government on a specific Alabama Power-TVA contract involving the Muscle Shoals development. Those who expected complete clarification on the constitutionality of the project were disappointed. A buying wave in copper was checked and the price remained at 9.25c., Valley. However, the European market for copper strengthened, with advices from abroad indicating that many operators there believe that the advance in this country has only been postponed. Domestic sales for February totaled 78,650 tons, which compares with 33,165 tons in January.

Producers of lead contend that consumption of the metal in this country will increase appreciably during the second quarter of the year, and, with a fairly active buying movement in the last week of the month, the price was advanced 5 points on two occasions.

Statistically, the zinc market is in a favorable position. Higher London prices and renewed buying interest here were followed by an advance to 4.90c.

The Tin Committee voted to reduce the production quotas for the second quarter to 85 per cent.

The *E. & M. J.* index of non-ferrous metal prices for February was 71.65, against 72.25 in January. The decline resulted from a lower monthly average for silver.

Readers desiring more frequent information on non-ferrous metal prices and market conditions are referred to *Metal and Mineral Markets,* the weekly market service of *E. & M. J.* Special telegraphic service, weekly or monthly, at nominal cost, is also available to those who want quotations quicker than they can be received through *E. & M. J.* and *M. & M. M.* For further information address the Editor.

United States Market

1936 Feb.	Electrolytic Copper Domestic (a)	Electrolytic Copper Export (b)	Straits Tin New York	Lead New York	Lead St. Louis	Zinc St. Louis
1	9.025	8.425	48.375	4.50	4.35	4.85
3	9.025	8.400	48.125	4.50	4.35	4.85
4	9.025	8.375	48.000	4.50	4.35	4.85
5	9.025	8.425	47.875	4.50	4.35	4.85
6	9.025	8.450	47.625	4.50	4.35	4.85
7	9.025	8.450	47.750	4.50	4.35	4.85
8	9.025	8.450	47.750	4.50	4.35	4.85
10	9.025	8.475	47.875	4.50	4.35	4.85
11	9.025	8.525	48.125	4.50	4.35	4.85
12	Holiday	8.550	Holiday	Holiday	Holiday	Holiday
13	9.025	8.550	48.000	4.50	4.35	4.85
14	9.025	8.550	47.875	4.50	4.35	4.85
15	9.025	8.600	48.000	4.50	4.35	4.85
17	9.025	8.625	48.125	4.50	4.35	4.85
18	9.025	8.675	47.750	4.50	4.35	4.85
19	9.025	8.675	48.000	4.50	4.35	4.85
20	9.025	8.675	48.125	4.50	4.35	4.85
21	9.025	8.650	47.500	4.50	4.35	4.85
22	Holiday	8.650	Holiday	Holiday	Holiday	Holiday
24	9.025	8.650	47.500	4.50	4.35	4.85
25	9.025	8.675	47.500	4.50	4.35	4.85
26	9.025	8.675	47.875	4.55	4.40	4.90
27	9.025	8.675	48.750	4.60	4.45	4.90
28	9.025	8.650	48.375	4.60	4.45	4.90
29	9.025	8.650	48.250	4.60	4.45	4.90
Av. for month	9.025	8.566	47.962	4.515	4.365	4.859
Averages for Week						
5	9.025	8.417	48.167	4.50	4.35	4.85
12	9.025	8.483	47.825	4.50	4.35	4.85
19	9.025	8.613	47.958	4.50	4.35	4.85
26	9.025	8.663	47.700	4.51	4.36	4.86
Calendar Week Averages						
1	9.025	8.454	47.604	4.500	4.350	4.842
8	9.025	8.425	47.854	4.500	4.350	4.850
15	9.025	8.542	47.975	4.500	4.350	4.850
22	9.025	8.658	47.900	4.500	4.350	4.850
29	9.025	8.663	48.042	4.558	4.408	4.883

Silver, Gold, and Sterling Exchange New York and London

1936 Feb.	Sterling Exchange "Checks"	Sterling Exchange "90-day Demand"	Silver (c) New York	Silver London	Gold London	Gold (d) United States
1	5.00375	4.99750	(e)	(e)	141s	$35.00
3	5.02250	5.01500	44.750	19.8125	140s 11 d	35.00
4	5.02375	5.01875	44.750	19.7500	140s 6 d	35.00
5	5.01375	5.00875	44.750	19.4375	140s 10 d	35.00
6	5.01125	5.00625	44.750	19.4375	140s 11 d	35.00
7	5.01750	5.01250	44.750	19.5625	140s 7½d	35.00
8	5.02000	5.01375	(e)	(e)	140s 8 d	35.00
10	5.01375	5.00875	44.750	19.9375	140s 6 d	35.00
11	5.01000	5.00375	44.750	19.7500	140s 8 d	35.00
12	Holiday	Holiday	Holiday	19.6875	140s 10½d	Holiday
13	4.98000	4.97375	44.750	19.8750	140s 10½d	35.00
14	4.98750	4.98125	44.750	20.0000	140s 10 d	35.00
15	4.99750	4.99125	(e)	19.8750	140s 11½d	35.00
17	4.99250	4.98500	44.750	19.8125	140s 11½d	35.00
18	4.98000	4.97250	44.750	19.9375	141s 2 d	35.00
19	4.98875	4.98125	44.750	20.0625	141s ½d	35.00
20	4.98625	4.97875	44.750	20.0000	141s 1 d	35.00
21	4.98625	4.97875	44.750	19.8750	141s 1 d	35.00
22	Holiday	Holiday	Holiday	19.8750	141s ½d	Holiday
24	4.99500	4.98875	44.750	19.8750	141s	35.00
25	4.99250	4.98500	44.750	19.7500	140s 10 d	35.00
26	4.98750	4.97875	44.750	19.7500	141s ½d	35.00
27	4.99000	4.98125	44.750	19.7500	141s ½d	35.00
28	4.98875	4.98000	44.750	19.7500	141s 1 d	35.00
29	4.99000	4.98125	(e)	19.7500	141s 2 d	35.00
Av. for month	4.99908	.....	44.750	19.796	.....	35.00
Averages for Week						
5	5.01125	.....	44.750	.....	.....	.....
12	5.01450	.....	44.750	.....	.....	.....
19	4.98771	.....	44.750	.....	.....	.....
26	4.98950	.....	44.750	.....	.....	.....

Calendar week averages: New York Silver Feb. 1st, 44.750; 8th, 44.750; 15th, 44.750; 22nd, 44.750; 29th, 44.750.

(e) No quotation.

The above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis, add 0.225c. per pound, the average differential for freight and interest charges.

(b) Export prices are net at refineries on the Atlantic seaboard and include sales of domestic copper in the foreign market. Most sales in the foreign market are made on the basis of c.i.f. usual ports of destination—Hamburg, Havre, and Liverpool. The c.i.f. basis commands a premium of 0.300c. per pound above our refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes discount of 0.125c.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High-Grade zinc delivered in the East and Middle West in nearly all instances command a premium of 1c. per pound over the current market for Prime Western but not less than the *E. & M. J.* average for Prime Western for the previous month.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

(c) Silver other than newly mined domestic. Under Executive order issued April 24, 1935, the U. S. Government's price on newly mined domestic silver was established at 77.57.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold in imported ore or concentrate is at 99.75 per cent of the price quoted by the Treasury, which at present is equal to $34.9125 per ounce.

THE MARKETS

PRICES OF METALS . . . MISCELLANEOUS QUOTATIONS

London Market

Feb.	Copper Standard Spot	Copper Standard 3M	Copper Electrolytic Bid	Tin Standard Spot	Tin Standard 3M	Lead Spot	Lead 3M	Zinc Spot	Zinc 3M
3	34.5000	34.8750	38.5000	204.5000	197.2500	15.6875	15.7500	14.7500	15.0625
4	34.4375	34.8125	38.3750	203.7500	197.6250	15.5000	15.5625	14.4375	14.7500
5	34.6875	35.0625	38.8750	203.5000	197.8750	15.5000	15.5625	14.4375	14.7500
6	34.6250	35.0000	38.7500	202.7500	196.7500	15.5000	15.6250	14.4375	14.7500
7	34.8125	35.1875	38.7500	202.7500	197.0000	15.5625	15.7500	14.5625	14.8125
10	34.7500	35.1250	39.0000	203.5000	197.7500	15.6250	15.8750	14.5625	14.8125
11	35.0625	35.4375	39.2500	206.5000	199.5000	15.6875	15.8215	14.6250	14.8750
12	35.0625	35.4375	39.2500	208.7500	201.2500	15.6250	15.7500	14.6250	14.8750
13	35.1250	35.5000	39.2500	208.0000	201.2500	15.6875	15.8125	14.6250	14.8750
14	35.5000	35.8750	39.5000	207.0000	201.2500	15.9375	16.0625	14.6875	15.0000
17	35.8750	36.2500	40.0000	208.7500	201.7500	16.2500	16.3750	15.2500	15.5000
18	35.8125	36.1875	40.0000	208.0000	200.5000	16.3750	16.5000	15.2500	15.5000
19	35.7500	36.1250	40.0000	207.5000	200.5000	16.4375	16.5000	15.3125	15.5625
20	35.8750	36.1875	40.0000	209.3750	202.8750	16.6250	16.6875	15.6875	16.0000
21	35.8125	36.0625	40.0000	207.5000	201.5000	16.5000	16.6250	15.7500	16.0625
24	35.9375	36.3125	40.0000	206.7500	200.7500	16.4375	16.6250	15.9375	16.2500
25	35.7500	36.1250	40.0000	207.5000	200.8750	16.3750	16.5625	15.7500	16.0000
26	35.7500	36.1250	40.0000	209.7500	201.5000	16.2500	16.3750	15.7500	16.0000
27	35.5000	35.8750	40.0000	213.0000	203.0000	16.4375	16.5000	15.8750	16.0625
28	35.6250	36.0000	39.7500	212.5000	203.5000	16.4375	16.5000	16.1875	16.3125
Av. for month...	35.313	.....	39.463	207.081	.....	16.022	16.141	15.125	15.391

Current Prices—Miscellaneous Metals, Ores, and Non-Metallic Minerals

Quotations cover wholesale lots, prompt shipment, f.o.b. New York, unless otherwise stated.

(March 2, 1936)

Miscellaneous Metals

Aluminum, ingot, 99 plus per cent, lb.	19@21c.
Antimony, domestic or Chinese (duty paid), lb.	12.625c.
Bismuth, ton lots, lb.	$1.00
Cadmium, lb.	$1.05
Chromium, 97 per cent grade, lb.	88c.
Nickel, electrolytic cathodes, lb.	35c.
Magnesium, 99.8 per cent, carloads, lb.	30c.
Palladium, troy oz.	$24.00
Platinum, (official quotation) troy oz.	$35.00
Quicksilver, flask of 76 lb., 100 flasks or more.	$77.00
Radium, mg. radium content	$50.00
Selenium, 99.5 per cent, lb.	$2.00
Silicon, minimum 97 per cent, spot, lb.	16.50c.
Tellurium, lb.	$2.00
Thallium, 100 lb. or more, lb.	$6.50
Titanium, 96 to 98 per cent, lb.	$6.00
Zirconium, commercially pure, lb.	$7.00

Metallic Ores

Beryllium Ore, f.o.b. mines, ton	$30.00@$35.00
Chrome Ore, 45@47 per cent, c.i.f., long ton	$16.00@$16.50
Iron Ore, Lake Superior, long ton:	
Old Range bessemer	$4.80
Mesabi bessemer	$4.65
Old Range, non-bessemer	$4.65
Mesabi, non-bessemer	$4.50
Lead (Galena) 80 per cent, Joplin, Mo., ton	$49.00
Manganese Ore, c.i.f. Atlantic ports, long ton unit:	
52@55 per cent.	26c.
49@51 per cent.	25c.
44@47 per cent.	24c.
Molybdenum Ore, 90 per cent, per lb. of contained MoS_2	42c.
Tungsten Ore, per unit of WO_3:	
Chinese duty paid	$16.00@$16.25
Domestic Scheelite	$16.00@.....
Vanadium Ore, per lb. of contained V_2O_5	27½c.
Zinc Ore, Prime, 60 per cent concentrate, Joplin, Mo.; per ton.	$32.00

Metallic Compounds

Arsenious Oxide (arsenic) lb.	3½c.
Cobalt Oxide, 70@71 per cent, lb.	$1.29@$1.39
Copper Sulphate, 100 lb.	$3.85
Sodium Nitrate, ex vessel, in 200-lb. bags, per 100 lb.	$1.29
Sodium Sulphate, bulk, ton.	$13.00@$15.00

Alloys

Beryllium-Copper, Master alloy, 3.5 per cent Be, per lb. of contained Be	$30.00
Ferrochrome, 65@70 per cent chromium, 4@6 per cent carbon, lb.	10c.
Ferromanganese, 78@82 per cent, gross ton.	$75.00
Ferromolybdenum, 50@60 per cent Mo, lb. of Mo contained.	95c.
Ferrosilicon, 50 per cent, gross ton.	$77.50
Ferrotungsten, 75@80 per cent, lb. of W contained.	$1.30@$1.40

Non-Metallic Minerals

Asbestos, f.o.b. mines ton:	
Canadian (Quebec)	
Crude No. 1	$500@.....
Crude No. 2	$200@$225
Spinning fibers	$90@$135
Paper stock	$32.50@$37.50
Shorts	$11@$14.50
Vermont	
Shingle stock	$47@.....
Paper stock	$35@.....
Cement stock	$23@.....
Barytes, long ton:	
Georgia, crude	$7.00
Missouri, 95 per cent $BaSO_4$, less than 1 per cent iron	$5.50
Bauxite, long ton:	
Domestic, chemical, 55@58 per cent	$6@ $7.50
Domestic, abrasive, 78@84 per cent	$12.50@$15.00
Dalmatian, 50@55 per cent	(a)$4.50@ $6.00
French, 56@59 per cent	(a)$5.50@ $6.50
China Clay, f.o.b. mines ton:	
South Carolina and Georgia, bulk	$7.00@ $9.00
Delaware, No. 1	$14.00@.....
Feldspar, bulk, ton:	
Potash feldspar, 200 mesh	$17.00
Glass-spar, white, 20 mesh	$11.75
Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois 85-5 per cent, all rail movement, ton	$17.50
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00@$14.00
Magnesite, per ton:	
Dead-burned, f.o.b. California	$25.00@.....
Dead-burned, f.o.b. Washington	$22.00@.....
Mica, per lb., North Carolina, No. 1 and 2 quality:	
1½x2 in.	15@30c.
2x2 in.	30@50c.
2x3 in.	50@65c.
3x4 in.	90@ $1.25
4x6 in.	$1.50@ $2.50
White, ground, 70 mesh, ton	$60.00@$80.00
Ocher, Georgia, ton	$19.00@$22.50
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports	(a) 12@ 12½c.
Silica, water-floated, in bags, 325 mesh, ton	$16.00@$40.00
Sulphur, Texas mines, long ton	$18.00@.....
Talc, f.o.b. works, ton:	
New York, double air-floated, 325 mesh	$12.00@$15.00
New Jersey, mineral pulp	$8.00@$10.00
Vermont, extra white, 200 mesh	$8.50@ $9.00
Tripoli, Missouri, ton:	
40 mesh, cream colored	$15.00@.....
200 mesh, cream colored	$25.00@.....

(a) Nominal.

Iron and Steel

Pig Iron, Valley furnaces, gross ton:	
Bessemer	$20.00
Basic	$19.00
No. 2 Foundry	$19.50
Steel, base prices, Pittsburgh:	
Billets, gross ton	$20.00
Structural shapes, 100 lb.	$1.80
Bars, 100 lb.	$1.85

MONTHLY AND YEARLY AVERAGE PRICES

Silver and Sterling Exchange

	New York		London Spot		Sterling Exchange	
	1935	1936	1935	1936	1935	1936
January	54.418	47.250	24.584	20.250	489.207	496.115
February	54.602	44.750	24.818	19.796	487.278	499.908
March	59.048	.....	27.380	.....	477.635	.....
April	67.788	.....	30.986	.....	483.596	.....
May	74.356	.....	33.865	.....	488.587	.....
June	71.940	.....	32.346	.....	493.245	.....
July	68.216	.....	30.500	.....	495.558	.....
August	66.366	.....	29.476	.....	496.815	.....
September	65.375	.....	29.255	.....	492.917	.....
October	65.375	.....	29.368	.....	490.577	.....
November	65.375	.....	29.284	.....	492.277	.....
December	58.420	.....	25.563	.....	492.715	.....
Year	64.273	.....	28.952	.....	490.034	.....

New York quotations for silver not eligible for sale to U. S. Government, cents per ounce troy, 999 fine. London, pence per ounce sterling silver 925 fine. Sterling exchange in cents.

Copper

	F.O.B. Refinery				London Spot			
	Electrolytic						(a)	
	Domestic		Export		Standard		Electrolytic	
	1935	1936	1935	1936	1935	1936	1935	1936
January	8.775	9.025	6.583	8.358	28.077	34.706	31.261	38.788
February	8.775	9.025	6.341	8.566	27.175	35.313	30.244	39.463
March	8.775	.....	6.526	.....	28.518	.....	31.607	.....
April	8.775	.....	7.328	.....	31.231	.....	34.763	.....
May	8.775	.....	7.794	.....	33.344	.....	36.733	.....
June	8.634	.....	7.307	.....	30.799	.....	34.039	.....
July	7.775	.....	7.350	.....	31.024	.....	34.261	.....
August	7.979	.....	7.738	.....	32.646	.....	35.976	.....
September	8.504	.....	8.146	.....	34.036	.....	37.952	.....
October	8.967	.....	8.514	.....	35.226	.....	39.609	.....
November	9.025	.....	8.414	.....	35.229	.....	39.396	.....
December	9.025	.....	8.414	.....	35.097	.....	39.313	.....
Year	8.649	.....	7.538	.....	31.867	.....	35.430	.....

New York quotations, cents per pound. London, pounds sterling per long ton. (a) Bid quotation.

Lead

	New York		St. Louis		London			
	1935	1936	1935	1936	1935 Spot	1935 3 Mos.	1936 Spot	1936 3 Mos.
January	3.692	4.500	3.542	4.350	10.321	10.514	15.397	15.494
February	3.528	4.515	3.378	4.365	10.216	10.413	16.022	16.141
March	3.579	.....	3.429	.....	11.012	11.188	.....	.....
April	3.692	.....	3.542	.....	12.231	12.459	.....	.....
May	3.962	.....	3.812	.....	13.861	13.940	.....	.....
June	4.020	.....	3.870	.....	13.776	13.806	.....	.....
July	4.123	.....	3.973	.....	14.451	14.511	.....	.....
August	4.254	.....	4.104	.....	15.774	15.792	.....	.....
September	4.413	.....	4.263	.....	16.262	16.315	.....	.....
October	4.512	.....	4.362	.....	18.209	18.209	.....	.....
November	4.500	.....	4.350	.....	17.938	17.935	.....	.....
December	4.500	.....	4.350	.....	16.803	16.828	.....	.....
Year	4.065	.....	3.915	.....	14.238	14.326	.....	.....

New York and St. Louis quotations, cents per pound. London pounds sterling per long ton.

Tin

	Straits New York		Standard, Spot London	
	1935	1936	1935	1936
January	50.916	47.234	231.193	209.731
February	50.063	47.962	227.381	207.081
March	46.962	.....	215.726	.....
April	50.154	.....	223.513	.....
May	51.138	.....	227.602	.....
June	51.108	.....	227.586	.....
July	52.297	.....	232.397	.....
August	50.463	.....	222.935	.....
September	49.126	.....	223.929	.....
October	51.160	.....	226.891	.....
November	51.864	.....	226.452	.....
December	49.794	.....	220.075	.....
Year	50.420	.....	225.473	.....

New York quotations, cents per pound. London, pounds sterling per long ton.

Zinc

	St. Louis		London			
	1935	1936	1935 Spot	1935 3 Mos.	1936 Spot	1936 3 Mos.
January	3.730	4.848	11.994	12.207	14.488	14.719
February	3.714	4.859	11.819	12.000	15.125	15.391
March	3.894	.....	12.095	12.250	.....	.....
April	4.030	.....	12.891	13.128	.....	.....
May	4.220	.....	14.534	14.685	.....	.....
June	4.299	.....	13.734	13.898	.....	.....
July	4.325	.....	14.065	14.185	.....	.....
August	4.535	.....	14.714	14.938	.....	.....
September	4.669	.....	15.414	15.616	.....	.....
October	4.825	.....	16.440	16.674	.....	.....
November	4.850	.....	16.193	16.372	.....	.....
December	4.850	.....	15.091	15.278	.....	.....
Year	4.328	.....	14.082	14.269	.....	.....

St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Cadmium and Aluminum

	Cadmium		Aluminum	
	1935	1936	1935	1936
January	55.000	105.000	20.000	20.000
February	55.000	105.000	20.000	20.000
March	58.462	.....	20.000	.....
April	65.000	.....	20.000	.....
May	65.000	.....	20.000	.....
June	65.000	.....	20.000	.....
July	65.000	.....	20.000	.....
August	70.000	.....	20.000	.....
September	75.625	.....	20.000	.....
October	85.000	.....	20.000	.....
November	85.000	.....	20.000	.....
December	101.800	.....	20.000	.....
Year	70.491	.....	20.000	.....

Aluminum in cents per pound, 99 per cent grade. Cadmium, cents per pound

Antimony, Quicksilver, and Platinum

	Antimony (a) New York		Quicksilver (b) New York		Platinum (c) New York	
	1935	1936	1935	1936	1935	1936
January	14.111	12.736	72.760	76.769	34.000	36.885
February	14.250	12.967	72.500	77.000	34.000	35.000
March	14.250	.....	72.500	.....	32.846	.....
April	14.029	.....	72.500	.....	32.000	.....
May	12.712	.....	72.135	.....	32.000	.....
June	12.500	.....	71.460	.....	32.000	.....
July	12.500	.....	70.538	.....	32.000	.....
August	12.500	.....	69.000	.....	31.333	.....
September	13.177	.....	69.208	.....	36.000	.....
October	15.322	.....	71.750	.....	37.615	.....
November	14.217	.....	74.348	.....	38.000	.....
December	13.820	.....	75.200	.....	38.000	.....
Year	13.616	.....	71.992	.....	34.150	.....

(a) Antimony quotations in cents per pound, for ordinary brands. (b) Quicksilver in dollars per flask of 76 lb. (c) Platinum in dollars per ounce troy.

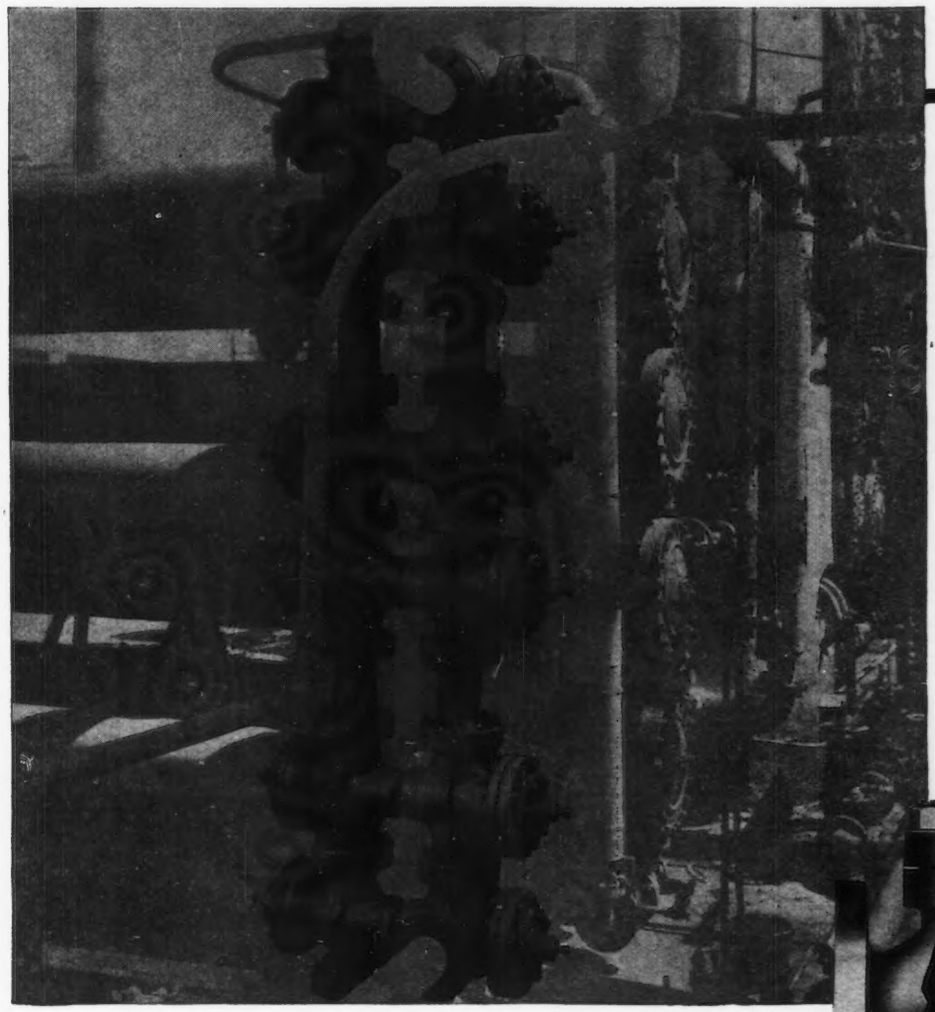
Pig Iron

	Bessemer		Basic		No. 2 Foundry	
	1935	1936	1935	1936	1935	1936
January	19.00	20.00	18.00	19.00	18.50	19.50
February	19.00	20.00	18.00	19.00	18.50	19.50
March	19.00	.....	18.00	.....	18.50	.....
April	19.00	.....	18.00	.....	18.50	.....
May	19.00	.....	18.00	.....	18.50	.....
June	19.00	.....	18.00	.....	18.50	.....
July	19.00	.....	18.00	.....	18.50	.....
August	19.00	.....	18.00	.....	18.50	.....
September	19.00	.....	18.00	.....	18.50	.....
October	19.00	.....	18.00	.....	18.50	.....
November	20.00	.....	19.00	.....	19.50	.....
December	20.00	.....	19.00	.....	19.50	.....
Year	19.167	.....	18.167	.....	18.667	.....

Iron in dollars per long ton. F.o.b. Mahoning and Shenango Valley furnaces.

WALWORTH

LUBRICATED PLUG VALVES



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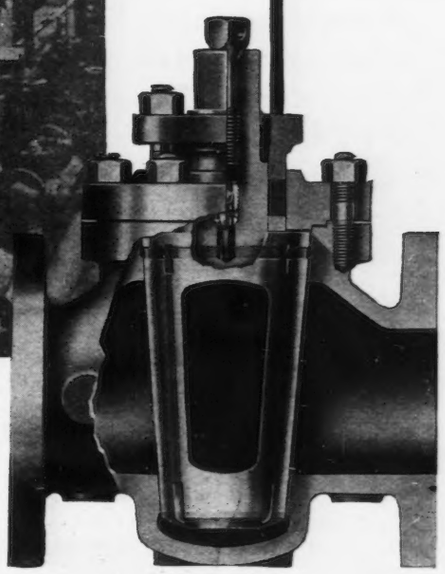

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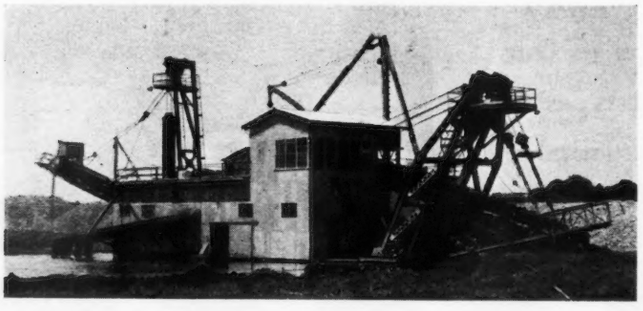

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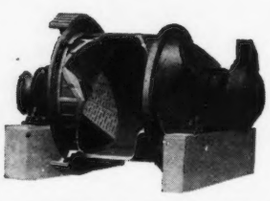

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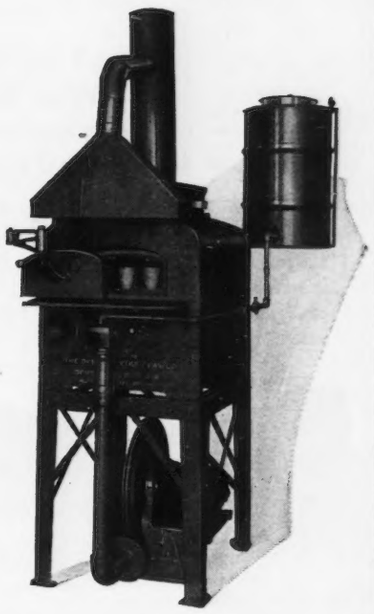

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Rugged properly proportioned mills of all sizes to meet the need of modern grinding.

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All important parts easily accessible and of proper design and construction—Low cost operation.

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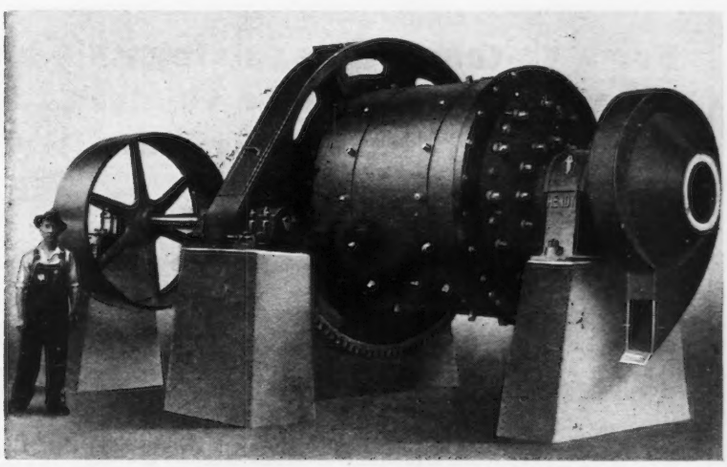

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★

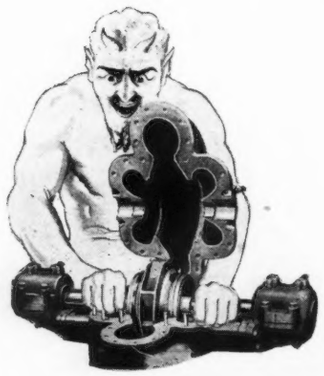
FLOTATION MACHINES - CRUSHERS - HOISTS - SKIPS AND CAGES - ORE CARS - ORE FEEDERS - TROMMELS HYDRAULIC GIANTS AND ELEVATORS

COMPLETE MINE-MILL EQUIPMENT

JOSHUA HENDY IRON WORKS

206 Sansome St., San Francisco Plant—Sunnyvale, Calif.

DON'T ALLOW OLD DEVIL "FRICTION" TO GET HOLD OF YOUR PUMP SHAFTS



He won't if you use

SQUARE **PALCO** PLAITED PACKING

as its abundant lubricant keeps the packing soft and prevents friction. This thorough lubrication not only prolongs the life of the packing, but enables the pump to develop its full efficiency.

For pumps handling sulphurous mine water, calcium brine, hot and cold water; also for hydrants, sewerage pumps and sprinkler systems.

Adapted to both centrifugal and reciprocating pumps.

Worn shaft, caused by hard, unlubricated packing.

Send for free working sample. State size.

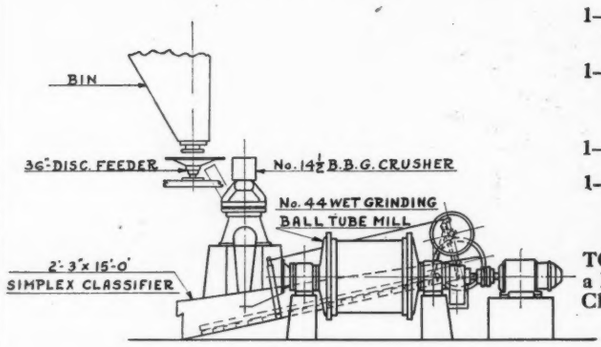
Put up in 1, 2 & 5-lb. packages.

GREENE, TWEED & CO.

SOLE MANUFACTURERS

109 Duane St., New York, N. Y.

For a 50-ton mill requiring 43½ hp. per day of 24 hours approximately all thru a 90-mesh screen or as close as it can be classified by any classifier, use the following:



1—36" Disc Feeder and Bin Gate combined. ½ hp. motor required.

1—No. 14½ Special Kennedy Ball Bearing Gearless Crusher for Fine Crushing with a 3" receiving opening. It can be driven by a flat or K-V belt from a 20 hp. motor.

1—Simplex Rake Type Classifier requiring a 3 hp. motor.

1—No. 44 Gearless Tube Mill with flexible drive shaft. It requires a 20 hp. back-geared motor or it can be driven from a countershaft.

TO DOUBLE THE CAPACITIES MENTIONED ABOVE, use a No. 55 Gearless Tube Mill which requires 40 hp., and a Duplex Classifier requiring a 5 hp. motor.

Kennedy Ball Bearing Gearless Crushers with the troubles left out will crush more rock of any size than any crusher in the world with a saving of 50% in hp. and 80% in the cost of maintenance. They are built in sizes weighing from 1,000 to 900,000 pounds.

Write for particulars and catalogue showing our complete line of mining equipment manufactured in the United States, Canada, Australia, France and England.

This Mill shows savings in the following:

1. First cost of equipment.
2. Cost of freight.
3. Cost of foundations.
4. Cost of installing machinery.
5. Cost of building.
6. Cost of power.
7. Cost of maintenance.

But most important it gives a uniform sizing.

This setup gives the Tube Mill a feed of approximately 90% minus ⅛" and therefore doubles its capacity over ordinary tube mill feed.

Before making definite recommendations, we should have a sample of your ore as our tables are based on medium hard clean ore.

KENNEDY-VAN SAUN MFG. & ENG. CORPORATION, 2 Park Ave., New York City

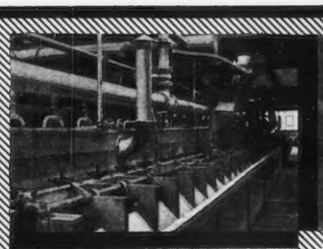
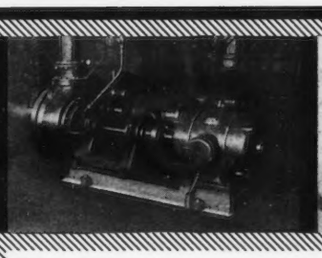
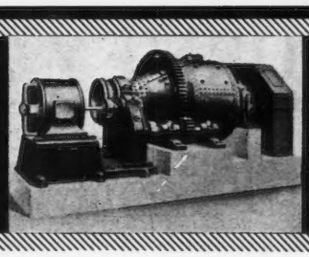
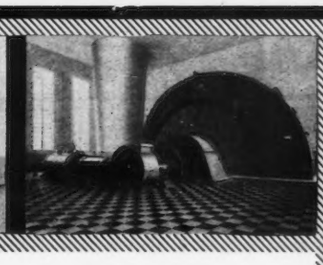
Cut Costs on Free Gold
with the CLARK-TODD AMALGAMATOR

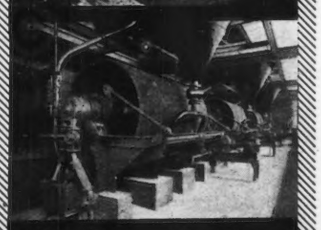
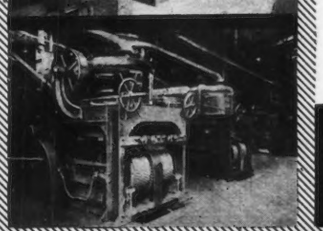
Save 95% of floor space required for plates . . . Stop THEFT . . . Eliminate *all skilled labor in amalgamation* . . . Save your free gold at lower cost than by any other method

Inside amalgamation with ball, rod and tube mills is being done successfully in conjunction with CLARK-TODD AMALGAMATORS operating in closed circuit with classifying equipment. The success of this method has been established time and again with no more loss of mercury than with plates. Now used by Homestake, Porphyry, El Canada and many others.

Write, Wire or Cable

THE MINE AND SMELTER SUPPLY CO.
Main Office, Denver, Colo., U. S. A.
EL PASO · SALT LAKE CITY · 1775 BROADWAY, N.Y.
HALLIDIE MACHINERY CO., SEATTLE

We have more than 60 years' experience in the field of

Coal and Ore Dressing

Some of our Specialities:

- Coal Washing and Screening Plants
- Briquette Making Plants
- Dust Extracting Plants
- Coke Oven Machinery
- Crushing and Pulverising Machinery
- Mine Ventilation Fans
- Haulage Winches
- Sand and Spiral Pumps
- Ore Concentration Plants according to the gravity or electro-magnetic process
- Flotation Plants according to the EKOF patents
- **Flotation Oils and Reagents of high efficiency**
- Vacuum Filtration Plants
- Classifiers – Thickeners

WESTFALIA-DINNENDAHL-GROEPPEL
AKTIENGESELLSCHAFT BOCHUM (GERMANY)

Another Satisfied User Orders Second Counter Balanced Mill

IN June 1934 the Alaska Empire Gold Mining Company, Juneau, Alaska, purchased a Gibson 25 ton Counter Balanced Rod Mill. Large tonnage—low power costs—minimum maintenance—all around satisfactory performance convinced this company's management of Gibson superiority.

Stating that our horsepower ratings—1/3 that required for a conventional single cylinder mill—were conservative, the company has ordered its second Gibson Counter Balanced Mill—this time a 100 ton mill.

Why not take advantage of the savings these field-proven mills offer? Consider these features:

1. Power required ⅓ that for single cylinder mill of same capacity.

2. Maintenance costs less due to manganese cylinders, easily replaceable.

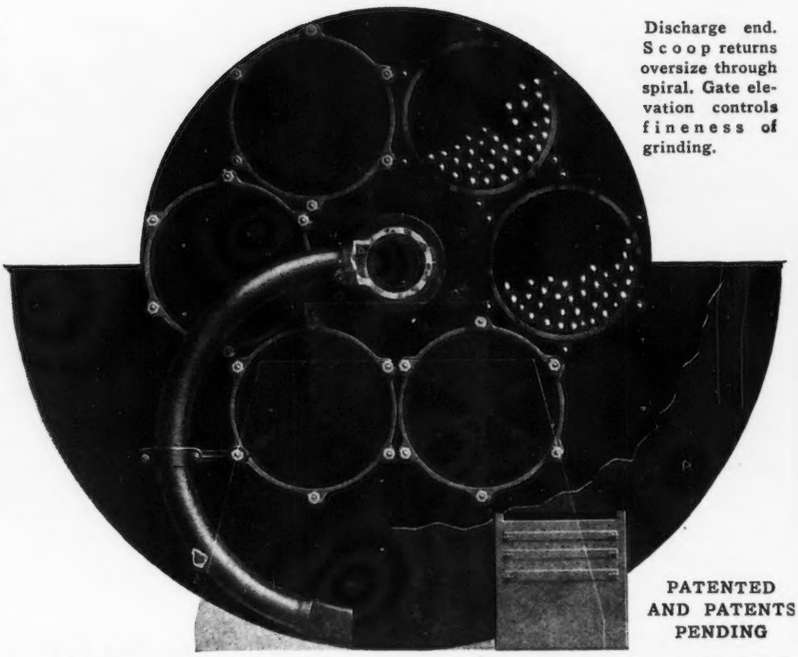
3. No screens to blind.

4. Capacity guaranteed—1 inch to 40 mesh in ball mills—3 inch to 40 mesh in rod mills.

5. Classifier self-contained.

6. Fine grinding assured.

WRITE for information regarding the Gibson Classifying Counter Balanced Rod or Ball Mill—"The Mills with a Guaranteed Capacity!"



Discharge end. Scoop returns oversize through spiral. Gate elevation controls fineness of grinding.

PATENTED AND PATENTS PENDING

• SEND for illustrated Catalog No. 15. Contains complete description of Gibson Counter Balanced Ball and Rod Mills, Prospectors' Friend Mills, Pocket Hunter Mills, Flotation Cells, Impact Amalgamators, Concentrators, Rock Breakers, Ore Feeders, Mercury Feeders, Oil Feeders, Retorts, etc.

W. W. GIBSON

112 Market St., San Francisco, Calif.

METAL SURVEY and OUTLOOK

TEN pages of factual and vital statistics on the production of and outlook for gold, silver, copper, lead, zinc, tin and nickel, by the leading authorities on these subjects.

For the FIRST TIME Anywhere

Five pages of World Charts, in color, showing the origin and flow of ten major metals and ores in international trade and—

The world famous ENGINEERING and MINING JOURNAL *Metal Price Chart*

A limited supply of this sixteen-page reprint, from the Annual Survey and Outlook number of Engineering and Mining Journal is available at 25 cents each—in lots of 25 or more, 15 cents per copy, postpaid. Send in your order today and avoid disappointment.

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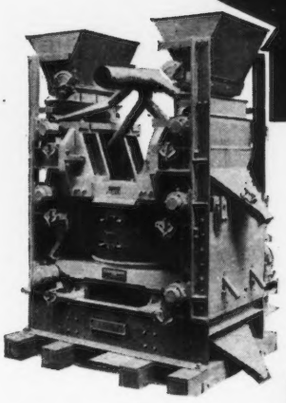
This Machine May Save You Thousands of Dollars!



Illustrated at the left is the Exolon Type C Separator

BY INCREASING yields and quality of concentrates now being produced by other separating equipment . . . by recovering heretofore worthless tailing dumps . . . and by improving or eliminating processes which may now include involved chemical treatment, the Exolon High Intensity Magnetic Separator is saving its users thousands of dollars every year.

The answer to your concentration and purification problems may likewise lie in this machine. If ordinary methods of magnetic, mechanical or chemical separation have not provided the solution, all the more reason why EXOLON should be considered, for EXOLON is not an ordinary separator.

Using less than 200 watt hours per ton of head feed, this equipment consistently performs separations that formerly were considered absolutely impossible. Built to precision standards, it is handling a wide variety of complex mineral combinations dependably, uniformly, almost automatically, day after day, under the most trying circumstances.

A production test of your material in our Laboratory may provide convincing proof that substantial savings can be effected through the use of the Exolon Separator. Write for Bulletin K-1, giving details of tests and complete specifications of equipment.

EXOLON

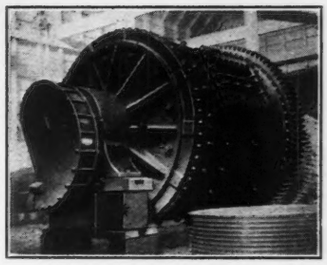
Magnetic Separators

THE EXOLON COMPANY

BLASDELL, N. Y.

STRAUB EQUIPMENT MEETS EVERY MILLING NEED

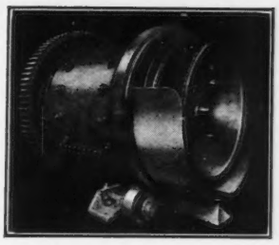
YOU save time, insure high mill efficiency and maximum recoveries when you rely on Straub equipment. Hundreds of successful operators throughout the world have proved that they have saved by the use of Straub equipment. It is designed by *field* experienced engineers.



Start your program to cut costs now! Write today for new catalog that shows many ways of reducing operating expenses.

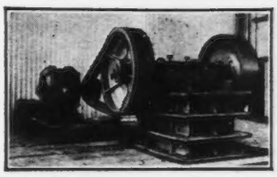
• Above, Rib-cone Ball Mill, all-steel, for enormous circulating loads in closed circuit. At right, Rib-cone mill and screen wheel classifier in closed circuit.

• Change-head type of Rib-cone. Can be fitted with screening discharge head, on a low pulp line, or a plain overflow head. Ideal for custom or pilot mills.



• Heavy duty all-steel Crushers for primary or secondary reduction. Brute strength guarantees low costs!

• Concentrating tables, simple and practical design—just one moving part! HIGHEST RECOVERY.



• Other Straub quality products—Portable stamp mills, feeders, classifiers, gates, amalgamation barrels and plates, mercury feeders, mine cars, water wheels, sectional boilers, etc. Your inquiry welcomed.

MAIL NOW

CLIP COUPON

STRAUB MFG. CO. MINING MACHINERY

STRAUB MFG. CO.,

567 Chestnut St., Oakland, Calif.

Yes, I am interested in cutting my mining costs. Send me your Bulletin No. 300.

Name .....

Company .....

Address .....

City .....

Country .....

What the Mining Operators Tell Us

In the November, 1935, issue of "Engineering and Mining Journal" a full page advertisement appeared concerning the current edition of METAL QUARRY CATALOGS.

Briefly, the message it conveyed to the "men who specify and buy" for the mining properties, was this—

"We will be glad to send you a copy of the 1936 METAL QUARRY CATALOGS, if you will ask for it on one of your letterheads, giving your position and—if located outside the U.S.A.—your assurance that you will take care of any customs charges imposed by your country."

The response was immediate!

Here, in their own words, is what a few of the operators tell us.

—these comments* from users prove it!

From Rochford, So. Dakota.
"Thanking you in advance for early shipment of Metal Quarry Catalogs as we are in the market for various items, including equipment, we are" . . .

From Orient, Wash.
"We have a number of the Metal Quarry directories here at the mine, the last being 1931. I judge from this that this mine is probably registered with you and catalogs were sent during the years the property was in operation. If this is the case and you have a recent edition that you could send us, we should be glad to receive it at your convenience. We are contemplating putting in a 50-ton flotation plant this winter."

From Seattle, Wash.
"We would appreciate receiving a copy of this excellent work (Metal Quarry Catalogs), which I have found of great value in the past. Thanking you for this favor."

From Los Angeles, Cal.
"Ever since you sent me a copy of your Metal Quarry equipment Catalog, in 1927, I think it was, I have found it very useful; however, the equipment therein is getting to be somewhat outmoded at the present time, so I am writing you now, with the request that you send me an up-to-date Catalog. I am active in both the metallic and non-metallic fields at present, consulting and designing for various companies and for gold, silver and lead mines in California, Mexico and Central America, so could use the Catalogs dealing with the metallic and non-metallic fields.

"I have been requested by ———— of South America to obtain a Catalog for their purchasing office and mine. All purchases are made from their Los Angeles office while the mine is located in Honduras, South America. It would be a great help to them if you could send a book to both places."

From Houghton, Mich.
"We would appreciate receiving for the Department of Metallurgy and Ore Dressing a copy of your Metal Quarry Catalogs, 1935-36 edition as shown on Page 42 of the Engineering and Mining Journal. The writer is responsible for ordering all the metallurgical and ore dressing equipment of this department which runs into a considerable amount each year. We have had a copy of Metal Quarry Catalogs for a number of years and find the service very excellent."

From Basin, Montana.
"I would like to have my name placed on your list of those to receive the Metal Quarry Catalogs for 1936. I have a copy of last year's book and find it to be very helpful."

From New York City.
"I shall be very glad to receive your Metal Quarry Catalogs. I am interested in this Catalog because I want to buy some engines to send to Argentina."

*** These comments picked at random from hundreds of letters received!**

From Malvern, Arkansas.
"We would like to take advantage of your offer to send us one of the new Metal Quarry Catalogs. We find this catalog very useful in many respects and will appreciate the new one very much."

From Baker, Oregon.
"We would appreciate having a copy of the Metal Quarry Catalogs for 1936. We already have a complete file of this catalog and therefore want to bring this file up to date."

From Chicago, Ill.
"I note in the current Engineering and Mining Journal that the new Metal Quarry Catalog is off the press and since this society, as well as the writer, have always been on your mailing list, I sincerely hope we will receive a copy in the not too distant future, as I would not wish to be without it. Trusting I may receive a copy of the 1936 edition and taking this opportunity to congratulate you on bringing out this great reference book, I am"

From San Jose, Cal.
"We are planning to incorporate very shortly and will be in the market for mining machinery and equipment so am writing to get the indexed collection of manufacturers' catalogs of machinery, supplies, equipment, etc. Also, any other information you may care to send. We have both gold and molybdenum."

From Spokane, Wash.
"Kindly enter my name and address on your mailing list for 'Metal Quarry Catalogs.' I am Chief Engineer for ————. We operate mines at Adin, Cal., Myrtle Creek, Ore., Marysville, Mont., Hailey, Idaho and Wallace, Idaho besides developing numerous prospects."

From Western Australia.
"From the 1st of November, I will be acting in a consulting capacity to English mining and financial interests in regard to the development and equipment of one of their properties, on a large scale, and would appreciate it if you would forward to me a copy of Metal Quarry Catalogs to which I could refer. Previous to this appointment I have been Assistant General Manager to the ———— and with the running of their new plant and the development of their property, the use of such a reference book for buying and the like would have been invaluable. Such was always available for my use while I was with the ———— and I appreciated its worth. Could you possibly see your way clear to send me a copy, for which I would be pleased to defray any expenses, and also for which I would be grateful?"

Other Mining Publications, Catalogs and Directory published by McGraw-Hill Publishing Co. include—

COAL AGE

ENGINEERING & MINING JOURNAL

METAL AND MINERAL MARKETS

COAL MINING CATALOGS

KEYSTONE COAL BUYERS MANUAL

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McGRAW-HILL PUBLISHING COMPANY, INC.

Catalog and Directory Division

330 W. 42nd St., New York, N. Y.